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ADAPTING INSTRUCTION TO THE LEARNING NEEDS OF CHILDREN IN THE INTERMEDIATE GRADES.
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THE EFFECT OF CHILDREN'S ACHIEVEMENT AND SOCIAL AND PERSONAL ADJUSTMENT UNDER A PROGRAM OF ADAPTED INSTRUCTION WAS INVESTIGATED. A SAMPLE INVOLVING ABOUT 700 STUDENTS WITH 30 DIFFERENT TEACHERS WAS USED. METHODS OF DIFFERENTIATED INSTRUCTION WERE PRESENTED TO THE TEACHERS IN A 3-DAY WORKSHOP TO THE OPENING OF SCHOOL. SUCH METHODS CONSISTED OF (1) ADJUSTMENTS TO ABILITY LEVEL, (2) ADJUSTMENTS TO LEARNING RATES, (3) SPECIAL SKILLS NEEDED, (4) SELF-DIRECTION AND SOCIAL LEARNING, AND (5) ENRICHING LEARNING AND MAKING IT SIGNIFICANT. ALL TEACHERS IMPROVED THEIR TECHNIQUES OF ADAPTING INSTRUCTION TO THE VARYING NEEDS OF CHILDREN. SCHOOL SUBJECTS DIFFERED IN THEIR ADAPTABILITY TO INDIVIDUALIZED PROGRAMS OF INSTRUCTION. THE PROGRAM RESULTED IN SIGNIFICANT IMPROVEMENTS IN ACHIEVEMENT IN GRADES 5 AND 6, BUT NOT IN GRADE 4. (TC)

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JOURNAL OF EDUCATION

ADAPTING INSTRUCTION TO THE LEARNING NEEDS OF CHILDREN IN THE INTERMEDIATE GRADES

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Harvey B. Scribner

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DONALD D. DURRELL LESLIE W. IRWIN WILLIAM C. KVARACEUS

The children in most classrooms present wide variations in mental ability and achievement, as every teacher knows. Successful group instruction for such pupils is a major problem and the School of Education at Boston University has sought and continues to seek means of helping them. This issue of the JOURNAL presents means of differentiating instruction for bright, average, and dull children in the same classroom. It offers helpful, practical information for the classroom teacher, the supervisor, and the administrator.

Donald D. Durrell has been a member of the Faculty of the Boston University School of Education since 1928 and is well known for his extensive educational research. John C. Manning and Walter J. McHugh are instructors in the same school. Harvey B. Scribner is Superintendent of Schools in Dedham, Massachusetts and George B. Rochfort, Jr. is Principal of the Kingsbury and Phillips Schools in Wellesley, Massachusetts.

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Edited by

Donald D. Durrell

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Chapter 1

ADAPTING INSTRUCTION TO THE LEARNING NEEDS OF CHILDREN IN THE INTERMEDIATE GRADES: A SUMMARY

Donald D. Durrell

In the spring of 1958, the United States Office of Education provided a research contract to Boston University for a study of differentiated instruction in self-contained classrooms. The town of Dedham, Massachusetts, was selected for the study. There were forty-seven intermediate-grade classrooms in eight elementary schools. The plan called for the measurement of achievements of pupils in these rooms in June 1958, to be followed by a program of differentiated instruction during 1958–1959, with an evaluation of that program through measures in June 1959. This monograph is an account of the procedures and the outcomes of that study.

Background for the Research Proposal. Uniform instruction appears to be prevalent in intermediate grades despite consistent research evidence of the wide differences among children in the same grade. For many years the staff at Boston University had emphasized the needs for and the techniques of differentiated instruction in elementary schools. Uniform instruction, however, was still widely followed among school systems in which teachers and supervisory staff had taken University courses. The obvious lack of transfer of professional instruction called for analysis.

In order to discover why differentiated instruction was omitted from many school programs, ten elementary school principals and supervisors were invited to a course in cooperative supervision. The course called for two separate weeks of full-time supervision in different school systems, with Saturday mornings devoted to preparation. On the last week of October 1957, the group went to Wallingford, Connecticut, to work in a single elementary school building. Each member of the group, including the two professors, worked with one teacher to see what changes could be made between Monday and Friday. It was quickly apparent that the supervisors lacked specific techniques of differentiating instruction in the various school subjects. They knew the theory of individual differences, could observe these differences among pupils, but were unable to initiate practices to take care of the observed needs.

Before the second laboratory experience, in which group techniques of supervision were to be employed with all of the teachers in a small school system, the supervisory group engaged in a search for materials and methods for differentiated instruction. Materials were prepared to supplement textbooks, study guides and lesson plans were built for different needs in the several subjects, and demonstrations were rehearsed for later use. These techniques and materials were tried out in the schools of the supervisors in the class. The second laboratory week was much more effective, but it was decided that the group should stay together for the year and work out a large variety of effective individualized procedures.

Since there was an evident need for clear evaluation of the importance of differentiated instruction, as well as for a demonstration center to serve the area, it seemed desirable to seek a research grant to support a study of a differentiated program in all subjects in intermediate grades. There are countless studies of improvement of achievement in each subject when special learning needs are met, but relatively few studies of achievements under programs of general improvement of educational service to pupils. The emphasis on a single subject may produce gains in that subject, but this may possibly be at the expense of other subjects. It seemed well to discover the effect of a program which provided for individual differences in all subjects of the elementary curriculum. Two evaluations of general instructional programs provided a pattern for this study: the 1941 evaluation of the integrated curriculum conducted by the Progressive Education Association,[1] and the study of activity programs by the University of the State of New York.[2]

There were several factors favorable to the immediate pursuit of the study. First, one of the members of the cooperative supervision group was Mr. Harvey B. Scribner, superintendent of schools in Dedham, Massachusetts, who invited the study to that town. Second, three of the young men in the group were available for research fellowships to conduct the study: Mr. Walter J. McHugh, Mr. John C. Manning, and Mr. George B. Rochfort, Jr. All had experience in elementary school teaching and in supervision, and all had spent the year in devising methods of differentiated instruction. When the request for a research contract was approved by the U. S. Office of Education, all participants were familiar with the proposed program and with the problems and techniques of pursuing it.

Selection of Services for Emphasis in the Program. One of the first problems was the selection of services for emphasis in the program. Since these schools followed a schedule of separate school subjects, as do most elementary schools, it seemed desirable to center the program on the objectives of these subjects. However, the list of objectives in each subject seems limited only by the imagination of the person discussing the subject; individual differences also appear in infinite variety. Some selection was necessary for an orderly approach to the services-to-pupils program and for a systematic evaluation of outcomes.

A practical solution appeared in the selection of the following services to students in the regular subjects of the elementary school curriculum:

Adapting instruction to various levels of ability.

Providing for different progress rates in learning.

Giving special help at points of weakness in learning development.

Encouraging individual and group self-direction and initiative.

Enriching learning, to make it significant and useful.

The first three of the services chosen for emphasis have wide research support for their inclusion. There is no doubt that children in the same grade differ widely in levels of ability in each subject; equally clear is that children progress at different rates when they are permitted to do so. The appearance of different special difficulties in each subject, even among pupils of the same level of achievement, is amply demonstrated by clinical experience and by diagnostic testing. The research evidence for the second two services is less clear, but both pupil initiative and enrichment of learning are included in all statements of educational objectives, and despite difficulties of definition and measurement, they were considered to be of high importance to a balanced program of differentiated instruction.

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[1] Progressive Education Association. *New Methods Versus Old in American Education.* Bureau of Publications, Teachers College, Columbia University, New York, 1941.

[2] University of the State of New York. *Activity Program: the Report of a Survey of the Curriculum Experience with the Activity Program in the Elementary Schools of the City of New York.* Albany, New York, 1941.

One of the conditions of the experiment was the continuance of the "self-contained classroom" in which one teacher teaches all subjects. As a consequence, there was no attempt to reorganize pupils by instructional levels, or to departmentalize instruction. The task was that of assisting the teacher to provide for individual differences among pupils who normally appeared in heterogeneously grouped classrooms.

Adjustments to individual differences must vary with the nature of the subjects taught. Arithmetic is so specific and logically organized that it permits relatively easy adaptations to levels and progress rates; individual differences in history, however, seem better served through programs which provide for variations in depth and breadth of knowledge. A general statement of the proposed methods of adjustment to the learning needs of children is as follows:

1. *Adjustments to ability level.* Textbooks and instructional materials will be fitted to the abilities of the pupils; pupil team instruction will be used; work in content subjects will be unified on central themes; different levels of study guides will be provided.

2. *Adjustments to learning rates.* In skills, children will progress at different rates; they may work in pairs, in teams, or alone; self-checking records of progress will be used. In content areas, learning rates will be cared for by curriculum-related specialties.

3. *Special skills needs.* There will be provision for practice at points of weakness; analysis of difficulties will discover needs; intensive practice materials will be provided to overcome troubles; grouping of pupils will be adjusted to need.

4. *Self-direction and social learning.* All children will have constant experiences in individual or team specialties in content learning; these will generally be curriculum-related. Teams will provide opportunities for mutual aid in learning; grouping for instruction will be related to learning objectives.

5. *Enriching learning and making it significant.* Whole-class instruction will be utilized when it is suitable, as in appreciations, new learnings, and in multi-sensory presentations. Many types of related activities and learning aids will be used. Skills instruction will be closely related to meanings, applications, evaluations. Organizational, elaborative, and critical thinking will be stressed.

The above statements indicate proposals rather than accomplishments. They served as guides in preparation of teaching materials and in planning techniques of instruction.

Development of the Team Learning Program. Children prefer to work in pairs and small groups in contrast to whole-class study or to working alone. This general knowledge was confirmed by a number of unpublished studies at Boston University. The preference for pupil team work was high; 80 to 95 per cent of pupils selected teams in hypothetical situations; after experience in working in teams, the preference for team study was maintained and increased.

In the development of the Dedham program, team learning aided the differentiation and enrichment of instruction in many ways. Whenever team learning promised to be equally or more effective than the practice it replaced, it was utilized. The following are some of the types of activities in which team learning was used:

1. *Team progress techniques in skills instruction.* Individual progress methods were well tested in the Winnetka approach.[3] Knowledge of progress is always an effective motivation in skills learning. In the current study, teams of two or three pupils were permitted to progress in arithmetic and spelling as rapidly as they could demonstrate mastery. Team progress was also utilized in skills in other subjects in which suitable materials were available; applied phonics was taught through paired practice in analysis and classification of new words. Systematic review of social studies concepts was provided in a similar manner.

   When team progress is permitted, it appears essential that the members of team be of approximately equal ability; a slower pupil is difficult for a team to tolerate. Teams were especially effective in problem solving in arithmetic, since mutual aid is provided for processes. Arithmetic appeared to be a thin subject for the upper third of the pupils; they were able to complete the work of two grades in a single year. The year's work in spelling was also completed rapidly by teams of high ability.

2. *Three- to five-man team discussions following whole-class presentation.* When pupils have read, listened to, or observed the same presentation, it is common to hold class recitation or discussion. While it is desirable to provide immediate pupil reaction to new knowledge, class discussion often results in low attention. Only one child can perform at a time; one's turn comes infrequently. Active participation, personal responsibility, and an important thinking task are necessary to effective discussion. Discussion teams of three to five pupils, with one acting as a recorder, generally replaced whole-class discussion. Group conclusions were shared by oral reading of the group summary, with other groups adding information from their lists.

   There was no attempt to control the quality and type of questions used in team discussions, although the following types were recommended: questions requiring organization and subordination of ideas; questions requiring various types of elaborative thinking, such as applications, uses, or relationships; questions requiring critical thinking, such as evaluation or pertinence in relation to suggested criteria.

   Grouping in team discussions was heterogeneous; children of different levels of ability appear to make effective contributions to discussion when their backgrounds of information are adequate.

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[3] Washburne, Carleton, *Adjusting the School to the Child.* World Book Co., New York, 1932.

3. *Team use of study guides to improve learning effectiveness.* Questions before or during study aid in the intake of ideas; questions after reading can only measure the harvest. Study guides to be used with teams of two or three pupils were commonly used in reading, history, and geography. Where common textbooks were used, teachers built and exchanged these guide sheets. The levels of the guides might vary; guides for slower pupils included glossaries for difficult words, and questions over details in short intervals of reading. Guides for brighter pupils used questions calling for elaborative or critical thinking and were over longer passages of material.

4. *Sections of the class.* When many pupils appeared to have similar instructional needs in any subject, they were grouped together for special help by the teacher. Controlled group progress, adjusting the pace of learning to the rate of mastery, appeared to serve slow learners well in some skills areas. New processes were illustrated and explained by the teacher, teams were then permitted to work through a series of lessons, then new units were introduced.

   Every-pupil response techniques were commonly used in teacher-led skills instruction. Learning tasks set orally by the teacher required simultaneous responses by pupils using various types of response cards.

   Occasionally, when books in content subjects were much too hard for slow learners and lower level books on the same topics were unobtainable the textbook was read orally by the teacher.

5. *Team or individual specialties in content subjects.* Depth and breadth in literature, history, geography, and science were provided by curriculum-related special reports. Calendars were prepared which aided advance assignments of special reports and displays on topics which came later in the courses of study in these subjects. The specialties were then presented at appropriate times. In general, the use of pupil specialties was limited to pupils in the upper third of the classes, although some teachers were able to use them more widely among pupils.

Team learning activities were unevenly developed among classrooms. While the team techniques were encouraged in the general program, not every technique was regularly used. Only when specific instructional materials were available was there an assured general use of the team technique. Team methods in spelling, arithmetic, phonics practice, were assured by such materials. Study guides aided reading and discussion in social studies. Other aspects of team learning depended on teacher initiative. Since uniform instruction in textbooks followed by class recitation was well entrenched, it was difficult to make complete changes in practice in a single year. However, the team learning aspect of the Dedham program was so general that it appeared to visitors to be the major feature.[4]

Individual and Whole-Class Instruction. Many classroom activities utilized individual learning and whole-class instruction. Certain objectives seem to require the pupil to work alone; others appear to be well served through whole-class presentation.

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[4] "Team Learning Launched." *Christian Science Monitor*, January 19, 1959. "All Pupils Aided by Team Learning." *New York Times*, June 14, 1959. "Teamwork Gets Play in Eastern Experiment." *Chicago Sunday Tribune*, June 28, 1959.

1. *Individual learning activities.* These included independent reading and study for special reports; writing of papers and essays; taking tests for evaluation and analysis; certain types of skills practice; and keeping records of learning achievements and needs.
2. *Whole-class enrichment activities.* Many of the appreciation objectives seem to be served by whole-class participation; some are probably enhanced by a child being a member of a larger group. When multisensory aids are used in the presentation of new information, pupils of all levels may profit by the same presentation. Some of the whole-class activities in which listening or viewing were predominant were the following: demonstrations, experiments, television or radio programs, motion pictures, slides, recordings, exhibits, displays, pupil reports, teacher explanation or direction. Activities involving group or whole-class participation were: impromptu dramatization, play reading, choral reading, singing, preparation of displays, class projects, games and contests.

Conduct of the Instructional Program. Methods of differentiated instruction were presented to the teachers in a three-day workshop prior to the opening of school. Since team progress methods in arithmetic and spelling were the easiest to introduce and experience had shown that they were most acceptable to teachers and pupils, the program was started immediately in these subjects. Guide sheets, record forms, and "ground rules" were worked out and exchanged among teachers. The research fellows were constantly available for demonstrations, consultation, and assistance in planning.

After the programs in spelling and arithmetic were running smoothly, differentiated instructional techniques in other subjects were developed and introduced. There was constant readjustment and experiment throughout the year to improve services to pupils in different subjects. Specific approaches in the skills areas are outlined in Chapter 3; content subject methods are described in Chapter 4.

Evaluation of the Program. Evaluation of the program called for comparison of the achievements of pupils under the same teachers prior to and following the differentiated instructional program.

1. *Evaluation of the changes in service to pupils.* While changes in school services may be proposed, the actual changes may not always be found in classrooms to the degree required by the experiment. Furthermore, some teachers may have provided a high degree of differentiation prior to the experiment, with little change possible in the ensuing year. In order to evaluate this factor, the amounts and quality of differentiated service to pupils in each subject were rated for each teacher. The description of the instruments and methods employed in this rating and the results of the evaluations are found in Chapter 2. In every case, there were marked changes in service to the individual needs of pupils.

2. *Comparison techniques; control of variables.* Although there were many new methods and materials introduced in the several subjects taught, there were many common factors in the experimental and control years. Some of the common factors are the following:

    a. Teacher ability and personality. Since the same teachers provided the instruction both years, personality qualities, intelligence, educational background, and other factors which relate to teaching success were the same for both years. In the forty-seven classrooms, thirty-five teachers taught both years.

    b. Pupil ability. Since all of the intermediate-grade pupils in the community were included each year, it may be assumed that intelligence, socio-economic status, home emphasis on education, and similar factors which may affect pupil achievement were the same. Intelligence test results were available on all pupils in the study.

    c. Courses of study; textbooks. Although there were no changes in courses of study or basal textbooks, there were numerous variations in the use of textbooks and supplementary materials. In arithmetic, for example, a child who completed the textbook for his grade was permitted to go into the textbook of the next grade. Pupil specialties required the use of a great variety of reference books. Study guides and special skills materials designed by the teachers were added to the program. These changes in materials were necessary to the differentiated instructional program.

    d. Classroom organization; time schedules. The basic classroom organization remained the same both years; teachers taught all subjects to pupils of varying abilities. The time devoted to each subject was approximately the same, although this factor is difficult to control in a differentiated program.

3. *Uncontrolled factors affecting the experiment.* It must be acknowledged that many factors in addition to the differentiated program may have influenced the energy of the teachers and the achievements of the pupils. Among these are the following: the stimulating effect of any new program; the daily presence of the research fellows; the knowledge of comparative measures to be applied at the end of the study. Since the Dedham program attracted considerable public notice, there were many visitors from other school systems, local and national newspaper articles, special educational conferences, and other resulting activities which kept interest high.

    It is, of course, impossible to single out any experimental factor as the major element in the study. The results cannot be attributed to team learning alone, to pupil specialties, to discussion techniques, or to enrichment activities.

    The fact that this was a first attempt at the program of differentiated instruction, with no clear patterns available for many of the practices, and with constant new ventures and readjustments, must also be considered.

4. *Measures employed.* The following measures were used in May 1958 and in May 1959:

   Kuhlmann-Anderson Intelligence Tests.

   Metropolitan Achievement Tests.

   Pupil subject interest ratings; an informal scale.

   Social distance ratings; a modification of the Bogardus scale.

   School adjustment inventory: teacher ratings of pupils.

   Parent's satisfaction with school service; informal inquiry form.

   In addition, the entering fourth grades were given intelligence and achievement measures in September 1958. Details of informal scales are provided in Chapter 5.

5. *Statistical analysis:* The major statistical technique employed was the comparison of mean differences in achievements and ratings of pupils in the experimental and control years. Gains of pupils in the experimental year were also studied. Data were analyzed to discover the effects of the program at each grade level, in different subjects, in various ratings, and for children of different levels of intellectual ability.

SUMMARY OF FINDINGS

Of the thirty-five teachers who taught in both experimental and control years, twelve were in grade four, nine in grade five, and fourteen in grade six. In these classrooms during the experimental year there were 803 pupils, distributed as follows: 280 in grade four, 187 in grade five, 336 in grade six. The average intelligence quotient of this population was 107; the median class size was 25. The analysis of data resulted in the following findings:

1. All teachers improved in techniques of adapting instruction to the varying needs of children. Although teachers differed in amount and quality of differentiated instruction, every teacher in the experimental year rated higher than the top teacher of the control year. (Chapter 2, Table 2)

2. School subjects differed in their adaptability to individualized programs of instruction; skills subjects adapted readily, while content areas were less satisfactorily adjusted. (Chapter 2, Tables 1, 4)

3. The program resulted in significant improvements in achievement in grades five and six; no change was found in grade four. In both experimental and control years, achievements in all grades were considerably above the national norms. (Chapter 2, Tables 6, 7, 8)

4. Arithmetic achievement improved significantly under the differentiated program in grades five and six; the improvement was greater in problem solving than in computation. Grade four showed no change in arithmetic achievement. (Chapter 3, Tables 5, 6)

5. Spelling achievement improved significantly at all grade levels. (Chapter 3, Table 7)

6. Reading achievement improved significantly only in grade six; there was no significant change in reading achievement in grades four and five. (Chapter 3, Tables 8, 9, 10)

7. English achievement, as measured by a test of language-grammar skills, improved significantly in grade six, made a gain in grade five, but showed no change in grade four. (Chapter 3, Table 11)

8. History achievement did not improve under the program of differentiated instruction. (Chapter 4, Table 2)

9. Geography achievement improved significantly. (Chapter 4, Table 3)

10. Literature showed statistically significant improvements in achievement under the differentiated program. (Chapter 4, Table 4)

11. Science achievement improved under the experimental program, but the change was statistically significant only in grade six. (Chapter 4, Table 5)

12. Children with I.Q.'s of 120 and over benefited significantly in most subjects in grades five and six. Little or no change was found in grade four. (Chapter 3, Table 15; Chapter 4, Table 6)

13. Children with I.Q.'s between 95 and 119 improved significantly in most subjects in grades five and six; they showed slight, but statistically insignificant losses in grade four. (Chapter 3, Table 16; Chapter 4, Table 7)

14. Children with I.Q.'s below 95 generally made achievement gains; statistically significant gains were made in spelling in grade four, spelling and arithmetic problem solving in grade five, social studies and science in grade six. (Chapter 3, Table 17; Chapter 4, Table 8)

15. Boys made more improvement than did girls under the experimental program in all subjects in grades four and five; the reverse was true in grade six. (Chapter 3, Table 18)

16. Social distance scores, indicating attitudes of pupils toward each other, showed no significant changes under the experimental program. (Chapter 5, Tables 1, 2)

17. Pupil interest in school subjects showed improvement only in grade five; there were few significant changes in the ratings of separate subjects at any grade level. (Chapter 5, Tables 3 and 4)

18. The classroom adjustment of pupils, as rated by teachers, did not change significantly under the experimental program. (Chapter 5, Tables 5 and 6)

19. Parent satisfaction with school service was generally high in both experimental and control years; no important change was found in this rating. (Chapter 2, Table 5)

Chapter 2

DIFFERENTIATING INSTRUCTION IN THE DEDHAM SCHOOLS

Harvey B. Scribner

One of the chief responsibilities of a school committee is to upgrade education in the community. It was on this premise that the Dedham School Committee accepted the advice of the superintendent and gave complete authority in the spring of 1958 to do research on differentiating the instruction in grades four, five, and six for the school year 1958–1959. This meant that eight elementary schools with sixteen fourth-grade classrooms, sixteen fifth-grade classrooms, and fifteen sixth-grade classrooms would operate on a program of a complete change of service to the nearly 1,200 pupils involved. Furthermore, it gave the green light to the research staff, under the direction of Dr. Donald D. Durrell, to make plans for changing the service of forty-seven teachers from that of uniform instruction, which was common to nearly all, to a service of differentiated instruction.

Description of Dedham Schools. The Town of Dedham, Massachusetts, is a suburb of Boston and encompasses a population of about 23,000 people. There were in 1958–1959 4,002 pupils enrolled in grades one through twelve. Grades four, five, and six, around which this study centers, show the following enrollments by grade and teacher:

TABLE 1

Grade – Teacher	*No. in Class*	*Grade – Teacher*	*No. in Class*	*Grade – Teacher*	*No. in Class*
4–1	26	5–1	29	6–1	24
4–2	26	5–2	30	6–2	25
4–3	23	5–3	22	6–3	17
4–4	23	5–4	23	6–4	20
4–5	28	5–5	36	6–5	31
4–6	29	5–6	34	6–6	28
4–7	19	5–7	37	6–7	20
4–8	21	5–8	21	6–8	19
4–9	21	5–9	22	6–9	26
4–10	24	5–10	29	6–10	26
4–11	26	5–11	30	6–11	25
4–12	22	5–12	29	6–12	22
4–13	22	5–13	29	6–13	27
4–14	27	5–14	34	6–14	19
4–15	23	5–15	20	6–15	25
4–16	24	5–16	23		
—	—	—	—	—	—
16	384	16	448	15	354

A policy in the Town of Dedham provides that classes will be subdivided when the enrollment reaches forty.

Evaluating Teacher Service To Pupils. Since a program of "Adapting Instruction to the Learning Needs of the Children in the Intermediate Grades" was to be placed in the school system in the fall of 1958 on a research basis, it became the number one assignment to evaluate the level of instruction which had normally been offered. A second evaluation of service was to be measured during the research year and the amount of change recorded.

This phase of the research, which called for an evaluation of teaching services, would appear to present the impossible. The current literature relative to teacher rating would lead one to believe the task to be insurmountable. However, the need for such an instrument and the fact that the criteria to be measured had been defined (see Chapter 1) brought the errand into focus and a Subject Service Analysis Rating Scale was devised. This scale emphasized again the five indispensable services which were deemed a "must" for satisfactory teaching.

FIGURE 1

SUBJECT SERVICE ANALYSIS

Teacher.. School..

Grade.......................Date.................. Interviewer..

1. Uniform instruction, no specific planning.
2. Incidental, minor, occasional service.
3. Partial service, some planned provision, several additions to be made.
4. Major provision, few improvements or additions to be made.

Reading:	*1.*	*2.*	*3.*	*4.*
Level				
Progress rate				
Special needs				
Self-direction				
Enrichment				

Spelling:				
Level				
Progress rate				
Special needs				
Self-direction				

Language Arts:				
Level				
Progress rate				
Special needs				
Self-direction				
Enrichment				

Social Studies:	*1.*	*2.*	*3.*	*4.*
Level				
Progress rate				
Special needs				
Self-direction				
Enrichment				

Science:				
Level				
Progress rate				
Special needs				
Self-direction				
Enrichment				

Arithmetic:				
Level				
Progress rate				
Special needs				
Self-direction				

Contrary to the opinion expressed by many writers on the subject of teacher rating, the teachers showed no opposition to the evaluation of their services. There were many factors which could have contributed to this high degree of acceptability:

1. The criteria upon which their services were being rated were well defined.
2. The criteria established were all within the power of the teacher to control. They dealt specifically with the manner in which she served pupils in the classroom.
3. Teachers were relaxed by what they had learned relative to the purpose of the research.
4. Every interview was opened with the admission to the teacher that textbooks in the several subjects are designed for grade levels, yet the children in the same grade differ widely in many ways:
   - In levels of ability in each subject.
   - In rates of progress in learning.
   - In special difficulties in each subject.
5. Each teacher was advised that it was apparent that she was attempting to make provisions for individual differences under a textbook-controlled system and that the purpose of the interview was twofold.
   - (1) Determine what she was currently doing to accommodate the individual differences in ability which we all knew to be present.
   - (2) Bring to light problems which she encounters in allowing individual differences that assistance might be furnished to her in this effort in the future.

The Subject Service Analysis was administered by use of a standard interview designed to get from the teacher her most descriptive story of the service which she rendered to her pupils. Prior to its official use, it was given trial runs by the members of the laboratory class attempting to determine its reliability. The results from the beginning and throughout the project proved most exciting. After a period of training in its use, qualified personnel have proven through some one thousand experiences that its reliability is high. The standard interview took place in the teacher's classroom where the interrogator had ample opportunity to request evidence to support the teacher's description of her service. Two or more raters worked as a team. One served as the interrogator — but each person individually scored the appropriate level of the service rendered.

In the research program, 47 teachers were rated each year. The examiners always worked in pairs or larger teams but recorded their findings individually. The persons doing the rating were those working on the project, principals in the town, or persons who have been associated with the Boston University laboratory class. On a comparison of the ratings recorded by the two evaluators the correlation of the reliability of the technique proved to be *.93*.

In May of 1958, when the five persons associated with the research evaluated the services rendered by the Dedham teachers, a low level of differentiation was indicated. This would probably be true of the majority of classrooms country wide. This further emphasized the need for the research to determine the value to pupils of a program of differentiated service.

TABLE 2

COMPARISON BY SUBJECT OF MEAN TEACHER SERVICE RATING IN THE THIRTY-FIVE TEACHER CONTROLLED CLASSROOMS

**Subject*	*1958*	*1959*	*Highest Possible Score*
Reading	6.90	14.66	20
Spelling	4.63	12.40	16
Language Arts	6.09	9.80	20
Social Studies	6.85	13.77	20
Arithmetic	5.34	12.85	16

* Since science was not taught on an organized curriculum basis in all classrooms, teacher service ratings are not presented in this study in that area.

Uniform instruction was the dominant pattern for all but two teachers in all areas except reading. This is easily understood since administrative practices have unwittingly encouraged the bundling together of a classroom of children and dunking them en masse into the typical textbook material of the grade. Even though we know the wide range of abilities within a class, we have marched as an army through the texts on a day-to-day, week-by-week system except for some incidental additional services to the extremes. This frequently, in the case of the gifted, proved to be an added dosage of the same material.

In the spring of 1959, a second evaluation of teaching service was made. The results — changes in services — were most encouraging. Some teachers who were strictly uniform in 1958 had now moved into a program of differentiated services in nearly every subject area as described in Table 3.

TABLE 3

DISTRIBUTION OF SERVICE RATINGS OF THIRTY-FIVE CONTROL TEACHERS IN 1958 AND 1959

	1958	*1959*
76–78		5
73–75		3
70–72		2
67–69		1
64–66		7
61–63		2

TABLE 3 — Continued

	1958	*1959*
58–60		7
55–57		2
52–54		2
49–51		3
46–48		
43–45		1
40–42	1	
37–39	2	
34–36	4	
31–33	5	
28–30	11	
25–27	10	
22–24	2	
N =	35	35
M =	29.69	63.51
S.D.	4.26	9.03

A comparison of the distribution of ratings in 1958 and 1959 shows that every teacher in 1959 rated above the single highest teacher in 1958. There were limitations in some subject areas, however, due to the need on the part of those furnishing the leadership for additional insight and knowledge into the proper procedure to use. Too, a dearth of instructional materials to provide for differentiated levels was a constant handicap. In the areas of spelling and arithmetic, procedures were effected as explained in Chapter 3; but when it came to language arts and social studies the procedures were subject to additional initiative and pioneering on the part of the teachers. Adaptations were made, however, and a description of the accommodation of the teaching in the social studies and language arts will be found in Chapter 4.

Furthermore, it must be acknowledged that the degree to which the service existed in the individual classrooms depended upon many factors:

Leadership on the part of the principal of the school.

Willingness of the teacher to accept the change.

Ability of the teacher to move from mass teaching to a differentiated pattern with team activity.

Cooperation on the part of the teachers in sharing both ideas and materials.

Administrative Responsibilities. Initiating a program of differentiated service to pupils into a school system which is to affect the practices of forty-seven teachers and twelve hundred pupils is in itself a task. Seventy per cent of the teachers in the research had five or more years' experience thus establishing a pattern of teaching which had already become familiar to them.

TABLE 4

TEACHER EXPERIENCE 1958–1959

Years	*No. Teachers*
1–4	14
5–9	13
10–14	5
15–19	....
20 or more	15

The program became more adventuresome when it was decided to place it on an active status in every fourth-, fifth-, and sixth-grade classroom in each of the eight buildings across the town.

Step number one was the acceptance of the program by the School Committee. The various phases of implementing the procedures used are covered in other chapters of this report. A workshop prior to the opening of school, afternoon meetings, classroom demonstrations, small group conferences, and supervision by the two researchers all went into the program of initiating and encouraging the change in classroom service.

Early in the research year, several factors became evident from an administrative point of view concerning the program. Those subject matter areas that were clearly defined were more readily acceptable on an experimental basis to the teacher. Reports showed that nearly every teacher permitted youngsters to move forward in search of their level and at a rate of speed befitting their ability in spelling. A similar situation proved to be the pattern in arithmetic.

Immediately a decision had to be made. In which subjects, if any, would youngsters be permitted to continue into the work which is traditionally known as that of "the next grade?" Without research to support the decision but based on many factors which became evident from the nature of the subject matter, it was decided to follow this pattern:

Arithmetic — permit children to seek their level and to progress at a rate suitable to them as individuals by proceeding into the work of the grades above them as long as they could provide evidence of mastery.

Spelling — to proceed through the text and then into personal word lists.

Reading — to free the top groups for more personal reading that they might seek their level from materials of personal interest and in the content areas.

Social Studies and Language Arts — to build toward greater competency in the field through use of elaborative thinking, creative writing, pupil specialties, and other enrichment and meaningful practices within the scope of the grade.

THE PRINCIPALS

The principals were always in attendance but left the direct problems of administering the program to the two researchers until we entered Phase II at the administrative level which meant a transfer of the administration from the research fellows to the individual principals.

The Dedham principals had followed a four-year program of greater stress being placed upon them as instructional leaders. Each principal by policy was required to make a thirty-minute visit to a classroom each day and file a report of his findings. However, the programs which had been observed and reported upon as having "met the standards of a first-class educational program" were of the uniform instruction type. Now came the responsibility for widening and raising the standards of the instructional leaders — the principals — that they might continue to serve in the leadership role in the program of differentiated service to pupils.

As previously stated, the principals attended the meetings with the teachers; there were frequent conferences during the school day with each one attempting, first of all, to get a clear picture in mind of what constituted a classroom with the instruction adapted to the learning needs of the pupils. The efforts then turned to the use of the "instrument" for the evaluating of the services rendered by the individual teacher. This effort was all planned to place the principal in focus with his true role in the school — the educational leader.

Prior to the principals taking over from the research fellows, they would go in a group with the superintendent to a classroom where they would observe, perhaps, an arithmetic class for the full period. Following the observation, a conference would be held for, first, an individual evaluation and, then, a thorough discussion of the differences that might exist. This proved invaluable.

A second approach in the training was the play-back of taped interviews with each principal evaluating the interview and then a discussion of the findings.

Soon after the mid-year, the administration leadership was transferred from the research fellows to the principals. An indication of the change in their vision from the old to the new service which they sought for their classrooms can be realized as you compare the content of the old supervisory form to that of the new one which they played an active part in building.

Comparison of content of the Supervisory Form used before and after the research.

SELECTED ITEMS IN OLD FORM

Circle Proper Explanation of Your Interpretation

Instructor — Well prepared — Bit hazy — Relied on text — Not confident

Lesson — Had a definite point — Nothing in particular accomp.

Lesson — Had interest of all — Some not attentive — Mediocre interest

Class — All got point — Some got point — None got point — Too difficult

Class — Lecture type — Discussion by few — Discussion by all

SELECTED ITEMS IN NEW FORM

What accommodation did you see for the following:

Level for each pupil........................
....

Individual progress for each pupil
....

Teaching at points of weakness......
....

Self direction..................................
....

Enrichment.....................................
....

Draw the pattern or patterns that were used for organization as the class progressed.

THE TEACHERS

The program called for a constant evaluation of methods and procedures. It was a case of building and improvising as they proceeded in many instances. Teachers were called upon for suggestions and they served on committees with the research fellows in building guides to implement the five basic objectives of the plan.

At the end of the research year an anonymous questionnaire, answered by the teachers relative to their reactions of the manner in which the program had served the pupils in the five subject areas, indicated the following:

TABLE 5

Subject	*Excellent*	*Very Good*	*Good*	*Fair*	*Poor*
Arithmetic	19	11	13	3	1
Spelling	14	10	16	5	2
Reading	12	18	11	4	1
Soc. Studies	5	9	24	6	2
Lang. Arts	4	9	16	13	5

The reactions of the teachers toward the manner in which the program had served the pupils in the various subjects is difficult to evaluate. No evidence of their reaction to the manner in which the former program served the pupils in each subject area is available for comparison. Considering, however, that the program was new, that each teacher had to be encouraged to change her pattern of teaching, that suitable teaching materials were not available, and that a vast program of changes invited insecurity, the evaluations were accepted as very encouraging.

THE PARENTS

The local press carried many stories on the research that was to be undertaken. Parents, however, gave it little prominence in their thinking until the program was underway. Their first true realization of a change was when their youngsters reported that they were working with a partner or partners and moving ahead of others in the room. Likewise some reported that they were in the slow group and their friends were going at a faster pace.

Each school PTA had as one of its early meetings a program covering aspects of the new program. Demonstrations were planned with the actual classroom of youngsters in action. Questions after the demonstrations indicated a strong interest by all and a willingness by most to carry on the project since it was being done on a research basis. In the majority of cases where complaints were made the facts would reveal the following to be true:

Complaint had no relationship to the program.

Misunderstanding of the true objective.

Lack of communication between school and parent.

Unwillingness to accept fact that differing abilities exist.

Average youngsters in past received top marks as the instruction and assignments were aimed at their level. With differentiated levels and progress rates, these children for the first time were out-distanced by the top achievers.

Insecurity on part of some teachers and principals passed along to the parent.

A survey for parent reaction to school service before and after the research year, however, proved that the situation was well in hand. Complaints so frequently are voiced louder and with far greater incidence of being repeated than are favorable remarks. This factor should be given considerable note as it so often deters many worthwhile changes that should be initiated.

TABLE 6
(Sampling of 10 classrooms)

Parent Reaction to School Service Before Program and In Spring of 1959

	Very Pleased	*Satisfied*	*Dissatisfied*
1958	35%	60%	5%
1959	38%	56%	6%

Pupil Achievement. It has been the policy in the Dedham schools to follow a testing pattern in the grades of:

(1) Intelligence tests, grades 1, 4, and 7.
(2) Achievement tests, annually each spring.

From these tests, it is indicated that the mean intelligence quotient for the past four years is 107. From the standardized achievement tests it is indicated that each subject area exceeds the national norm from six months to one year and six months.

TABLE 7
Comparison of Mean Standardized Achievement Scores in Grades 4, 5, and 6 with National Norms

Grade	*Total Ac.*	*1956*	*1957*	*1958*	*1959*
Four	Achievement	5.1	5.4	5.5	5.8*
	Norm	4.7	4.7	4.7	4.9
	Difference	+.4	+.7	+.8	+.9
Five	Achievement	6.2	6.1	6.8	7.2
	Norm	5.7	5.7	5.9	5.9
	Difference	+.5	+.4	+.9	+1.3
Six	Achievement	7.2	7.2	7.9	8.2
	Norm	6.7	6.7	6.9	6.9
	Difference	+.5	+.5	+1.0	+1.3

*Based on June Data. Other years on April test.

In 1957, it was decided to go beyond the surface treatment of the testing results and take a closer look at individual pupil growth. In making a comparison of the achievement of each pupil against that of his standing a year ago some provocative facts were learned. Even though the tests had indicated rather satisfactory achievement when considered as a composite, the individual analysis of pupils making a year or more of growth caused much concern.

TABLE 8

PUPILS MAKING FULL YEAR OF GROWTH IN GRADES 4, 5, AND 6 IN DEDHAM SCHOOLS ON STANDARDIZED TESTS

	1956	*1957*	*1958*	*1959*
Grade Four	51%	38%	66%	74%
Grade Five	46%	39%	50%	64%
Grade Six	53%	56%	61%	78%
Average	50%	44%	59%	72%

It is difficult to evaluate the individual growth results as there are few if any such statistics available on school systems. It is easy to note, however, that a significant change resulted at each grade level when comparing the 1959 percentages against the highest year previously reported. This change of teacher service which gave an opportunity to a much higher percentage of pupils to make a full year or more of growth is the most encouraging single factor of the experiment to the administration.

Achievement was measured for the experimental year by administering the tests in May of 1958 and again in May of 1959. Two different forms of the Metropolitan Achievement Tests were used for this measurement.

TABLE 9

AVERAGE ACHIEVEMENT COMPARISONS OF 35 CONTROL TEACHERS FROM METROPOLITAN ACHIEVEMENT TESTS ADMINISTERED SPRING 1958 (FORM R) AND SPRING 1959 (FORM T)

	1958 Mean		*1959 Mean*		*Gain*		
	Std. Score	*G. Equiv.*	*Std. Score*	*G. Equiv.*	*Std. Score*	*G. Equiv.*	*C.R.*
Grade Four	187.4	5.7	188.4	5.7	1.0	0	.8
Grade Five	202.2	6.6	206.9	7.0	4.7	.4	3.6
Grade Six	215.3	7.6	218.7	8.2	3.4	.6	2.6

CONCLUSIONS

1. There were marked changes in teacher service to pupils from 1958 to 1959.

   On the service-to-pupils rating scale, there was a mean gain of 30 points between the two years. The lowest rated teacher in 1959 was higher than the highest rated teacher in 1958.

2. Changes in differentiated instruction were made in all subjects.

3. The scale for evaluating teacher service to pupils showed a high reliability. Two raters on 70 teachers showed a reliability of ratings of .93. It is apparent that teacher services to pupils can be evaluated with a high degree of reliability.

4. From an anonymous survey it was learned that teacher acceptance of the program was excellent. Their evaluation of the services in separate subjects placed arithmetic, reading, and spelling as the best served, social studies and language arts as less well served.

5. Parental reaction to the program was favorable; ninety-four per cent reported being "satisfied" or "very pleased" with the program. However, this represented no change over the previous year.

6. The general achievement of pupils, as determined by the per cent of pupils making a year or more gain, improved in all grades. In grade four, the gain was 8%; in grade 5, 14%, in grade 6, 17%.

7. Grade achievement comparisons between 1958 and 1959 showed significant gains in grades five and six, no gain in grade four. Grade five achievement moved from 6.6. in 1958, to 7.0 in 1959, a gain of four months. In grade six, the achievement moved from 7.6 to 8.2, a gain of six months.

CHAPTER 3

TEAM LEARNING IN SKILLS SUBJECTS IN INTERMEDIATE GRADES

WALTER J. McHUGH

The purpose of this study was to initiate and evaluate methods for adapting instruction in the intermediate grades to the learning needs of children in reading, arithmetic, spelling, and language. Specific areas of services were:

1. *Reading:* silent and oral reading, word and study skills, comprehension, and correction of reading difficulties.
2. *Arithmetic:* meaning, computation, problem solving, and skills.
3. *Spelling:* mastery of spelling words in text, word meaning and imagery, transfer of spelling words to writing, and personal spelling lists.
4. *Language:* outlining, creative writing, proofreading, usage, and mechanics of writing.

Other areas of language and reading allied to this study of differentiated instruction, namely, the uses of reading, poetry, literature, reading in the content areas, discussion, and reporting are described in Chapter 4 as they are more closely related to the content areas.

The effects of the program on subject preference, social distance, pupil adjustment, and parental satisfaction with school service under this program of team learning are reported in Chapter 5.

GENERAL PLAN OF SUPERVISORY SERVICES

A research team was organized consisting of a director and two full-time research fellows who developed, initiated, supervised, and evaluated methods and techniques.

Preliminary Planning. In order that the plan could be put into operation as soon as the school year began, the research team held many conferences during the summer of 1958. This involved a critical analysis of all textbooks used in the schools. Lessons, techniques, and materials in the texts were reviewed in terms of their acceptability in light of newer research findings and ineffective lessons and techniques were discarded as newer techniques were substituted in their place. Basically, the research team endeavored to adjust the materials to fit the learning needs of the individual child.

The services to be rendered to the teachers required that demonstration lessons, selection and preparation of self-administering skills practice materials, systems for recording individual progress, the use of supplementary resources, and other aids to teaching be developed before the school year began, as all instruction, except for demonstration lessons, was to be given by classroom teachers.

The First Workshop. On the first three days of the school year all intermediate grade classes were canceled so that the teachers could take part in a three-day workshop conducted by the research team. The purpose of this workshop was threefold. The first task was to point out the wide range of abilities present in the intermediate grades and this was done by posting on a blackboard frequency distributions of I.Q. and achievement scores of a typical class. Questions from teachers evidenced concern as to how they would adjust their teaching to wide ranges of ability. Discussion in small groups followed, with many teachers giving suggestions as to how this could be accomplished. The sharing of ideas and problems was done primarily to make the teachers aware of the individual differences present in any classroom and attempt to discover common solutions to these problems.

The second task was to explain in detail the five major objectives underlying the plan to individualize instruction. These five major objectives are mentioned in the selection of services for emphasis section in Chapter 1. A major part of the time of the workshop was devoted to answering teachers' questions, making clear the objectives, and explaining different types of classroom organization and grouping. To determine which teachers were willing to begin the new program was the third task. It was also necessary to determine with which subjects they wanted to begin.

The results of a questionnaire to teachers showed they all wanted to begin individualized instruction after the first two weeks of school. Although some teachers wanted to begin with content areas, the majority favored spelling and arithmetic.

Individual Differences Among Teachers. It would be a fallacy to assume that the teaching faculty were poured from the same mold. There is as wide a range of abilities and interests among teachers as children. In undertaking a program of this nature it was important that the research team keep paramount in their thinking that the teaching personnel:

1. were of various backgrounds and preparations for teaching the intermediate grades,
2. had various amounts of flexibility, stability, and interest in research,
3. were of varying levels of competency and professional training,
4. possessed various philosophies on education and theories on the learning process and child development.

Since these conditions were present, the research team had to consider not only the children but also the teachers. Teachers would adapt instruction at different times, as they were ready and secure enough in venturing on to newer and varied practices. Teaching, because of its personal as well as scientific nature, had to be considered in light of each individual staff member. It was the task of the supervisory team to work individually and cooperatively with each teacher and classroom.

School Assignments for Training Teachers. Two members of the research team, the writer and another research fellow, were delegated to full-time supervision of the program. For the purpose of supervisory organization and control, the research team agreed that the most suitable plan would be to divide the responsibility for teacher training activities among the two research workers and the eight schools. One supervisor worked in four schools, containing twenty-three intermediate-grade classrooms, on one side of the town, and the writer was assigned the remaining four schools, containing twenty-four intermediate-grade classes, on the other side of town. Delegating the schools to the supervisors on a geographical basis minimized the amount of time needed for travel between the schools during the school day.

Training Teachers in Grouping Children. To facilitate discarding whole class instruction and to make teachers acutely aware of individual differences, it was decided to request listings of pupils by subject according to high, average, and low achievers. During the first two weeks of school, duplicate listings were made, utilizing achievement test scores, teacher observation and judgment, pupil adjustment in the classroom, and results of informal tests administered by the teacher. One copy was kept by the teacher, the other forwarded to the research team for reference use.

Demonstration Lessons for Individualized Instruction. During the third week of school, individualized instruction in spelling was initiated. A demonstration class was planned and taught by the supervisor, using a class of children from School A. Each of the six intermediate-grade teachers and the principal of the school observed the demonstration lesson. Duplicated copies of each step of the lesson were distributed before the demonstration took place.

At the conclusion of the demonstration lesson the supervisor met with teachers and principal to clarify the objectives and techniques employed and to answer questions concerning the program for individualized instruction in spelling. At this point, each teacher was given the choice of either organizing and initiating the individualized spelling program in his room or requesting the supervisor to introduce it to the class. Most teachers desired to introduce the newer method themselves. On the following day each teacher started his class. The supervisor observed spelling lessons in each of the classrooms of the building, answering questions and assisting teachers. An after-school meeting was held to discuss the introduction of the program. Information, guidance, and suggestions were exchanged and vague or weak points explained. The third day was devoted to supervising the program, noting whether or not each individual was working according to his level, and rate of progress, receiving remedial and intensified instruction at points of weakness, and how self-directing assignments were being utilized.

As soon as the program was functioning well in School A, the same procedure was followed in School B, then in Schools C and D. The same program was followed concurrently in the other four schools in the town by another research supervisor.

The most important aspect of the program was maintaining it. After the successful introduction in each school, close supervision was necessary. Safeguarding the program through daily supervision assured the continuance of progress through individualized instruction. Figure 1 illustrates the supervisory schedule followed for introducing individualized instruction in each subject.

Supervisory Schedule for Introducing Individualized Instruction in Each Subject

	School A	*School B*	*School C*	*School D*
1st Day	Demonstration and Question Period			
2nd Day	Observation and After School Meeting			
3rd Day	Supervision	Demonstration and Question Period		
4th Day		Observation and After School Meeting		
5th Day	Supervision	Supervision	Demonstration and Question Period	
6th Day			Observation and After School Meeting	
7th Day		Supervision	Supervision	Demonstration and Question Period
8th Day				Observation and After School Meeting
9th Day			Supervision	Supervision
10th Day	Supervision	Supervision		

After the team-learning program in spelling had been introduced, carefully supervised, and maintained, the other subjects of the curriculum were introduced, following the same demonstration and supervision cycle as for spelling. The order of the introduction of subjects in the program was determined by their acceptability to teachers, the order of difficulty in handling each subject in the newer program, the availability of necessary supplementary materials, some of which had to be built by the supervisory team and teachers.

The order of introducing subjects was as follows:

1. Spelling, Sept. 15–30
2. Arithmetic, Oct. 1–15
3. Reading, Oct. 16–31
4. Language, Nov. 3–17
5. Social Studies, Nov. 18–26
6. Science, Dec. 1–5

Full-Time Supervision. As each subject was modified to team-learning techniques, the responsibility for the supervision of the program increased. Even after the successful introduction of a subject in the program, careful continuous supervision was necessary to assure that the teacher was handling the program with a minimum of difficulty.

This required full-time supervision by both research supervisors. Every day the supervisors visited classrooms, closely watching the progress of team learning, assisting teachers with problems related to learning difficulties of slow learners, and making provisions for high achievers who were advancing rapidly through the assignments in the skills subjects.

In addition to the full-time supervision of the program, afternoon meetings with teachers were held daily, with each school faculty meeting one afternoon per week to discuss problems, further expansion of the program, the building of new materials to adjust the learning to the wide range of differences present in each classroom.

At these meetings the sharing of materials, new ideas, and techniques for team learning lent new impetus to the program. Creativity on the part of teachers was highly encouraged. Teachers were well aware of the exploration of many different techniques to strengthen the program and contributed greatly to the refinement of materials and techniques.

Materials for the Program. Many of the materials required for adapting instruction to team learning had to be built by the research team and the teachers since commercial material for individual progress, self-correcting, and self-directing were not provided by publishers. During the after-school meetings in the several schools, materials were explained by the research supervisors, teachers were given the ideas, and it was suggested that they be modified according to the individual needs in their classroom. In varying degrees, teachers built the materials and put them to use in their own classroom.

There are various possibilities for adapting instruction to individual differences. Each subject has its own needs because of ranges in levels and differences in learning and progress rates. Each subject must therefore receive special consideration in adapting instruction.

PROGRAM OF INSTRUCTION IN ARITHMETIC

As mentioned in Chapter 1, textbooks and curriculum were controlled both years of the study. It was therefore necessary to adjust the existing texts and related materials to the objectives of the study. The textbook used in Dedham was the *Growth in Arithmetic* series, John R. Clark, *et al*, World Book Company, 1957.

To accommodate for differences in arithmetic, adjustments to the following needs had to be made:

1. To serve all levels of arithmetic ability present in a classroom.
2. To provide for children to acquire concepts and understandings at differing rates, so that all children would progress at their individual rate of mastery.
3. To overcome arithmetic difficulties through analysis, remedial instruction, and intensive teaching at points of weakness.

4. To allow for self-directing and self-correcting tasks in the interest of economy of time.
5. To provide incentive and motivation for self-discipline through individual progress methods.
6. To allow pupils to give mutual help in solving problems, reviewing facts, and allow immediate correction of work.

Arithmetic for High Achievers. To allow high achievers to work at their own level and rate of progress with high mastery was the first task in adjusting arithmetic instruction. In order to accomplish this task it was necessary to (1) set rules and standards so that high levels of discipline and order would be maintained at all times, and (2) adjust the arithmetic text to allow for self-direction, self-correction, and individual progress. The most suitable approach was building "job sheets," directing the child to the work to be done, how it was to be done, and the standards for acceptance.

The Job Sheets. Thorough examination of the arithmetic texts for grades four, five, and six resulted in complete listings for each grade of concepts, fundamentals, and skills to be introduced or reviewed. The next step was to determine the amount of practice and drill that should be built into the job sheet in order to provide sufficient practice for mastery, yet unburden the high achiever of the unnecessary amount of practices that the text provides.

In building the job sheets, these objectives were closely adhered to:

1. No concept, understanding, or skill once introduced would be dropped, but rather, systematic review would be maintained throughout the text.
2. Word problem practices would not be sharply reduced, and the make-up of the job sheet would center much emphasis on practices in solving problems.
3. Hurdles, such as maintenance tests, would be spaced at intervals approximating ten days' work assignments so that no child would be advancing without complete understanding and mastery.
4. Opportunities for mutual aid would be provided by allowing children to work together. In computations, each child worked out the example alone, then was allowed to check with a partner, compare answers, correct or help as necessary. In solving written problems, both members of a team were to read the problem together (one orally), decide on the process involved, with one member of the team doing the necessary computation. Only one set of answers would be required on examples involving problem solving. After each problem the members of the team were to rotate in their function. Partner A would read the first problem, Partner B the second, etc. This would allow both members of the team opportunities for each of the two tasks involved.
5. Each new concept was to be introduced through a meaningful situation, from concrete to semi-concrete, and finally to the abstract, in practice and drill-type exercises. New concepts could be handled in either of two ways. Since the text made adequate presentation for

new concepts, self-explanatory in nature, employing many visual illustrations and examples and in large measure self-teaching, children would be encouraged to "unlock" the new concept for themselves. The second method was for the teacher to introduce the new concept if she felt the need, or if pupils evidenced need for assistance. When several children were approaching the introduction of a new concept, the teacher could take them as a group and teach it to them. Whenever the teacher felt the need for teaching a group, she would be encouraged to do so.

6. High standards of workmanship were to be maintained at all times. Never was a child to advance without ninety per cent mastery. Incorrect problems had to be repeated. Teacher-made standards for neatness and legibility were to be stressed and maintained.
7. Close check of pupil progress would be necessary. This would necessitate pupil record charts. Each child was to keep a record of his own progress and grades. Teachers were to keep records of maintenance and qualifying tests for reporting progress to parents, report cards, etc.
8. Provision for immediate correction was included in the job sheet. Ten answer booklets were to be provided to each classroom. This would allow pupils to correct their work immediately upon completion, when their interest was highest and their work fresh in their minds, rather than waiting until the next day to discover how they were doing.

Arithmetic for Average Achievers. Since the arithmetic text provided adequate presentation for average pupils, individualizing instruction for this group was much easier than for high achievers. To allow the average achievers to work at their individual levels and progress rates was the primary objective in initiating team learning for this group.

The first task was to set rules and standards, and to allow for individual progress through self-directing and self-correcting assignments. These were similar in nature to the rules for high achievers. The major differences were:

1. Controlled progress was achieved by allowing children to advance at spaced intervals. Five- and ten-day assignments were given to the children. They were allowed to progress through this work at their own rate, taking a test after the completion of the assignment.
2. Children were paired according to ability, were allowed to check with a partner, compare answers, correct or help as necessary. Answer booklets were provided for this group so that immediate correction would be possible.
3. All new concepts, understandings, and skills were introduced by the teacher.
4. High standards of workmanship had to be maintained, along with close check of pupil progress by the teacher.
5. Re-grouping of pupils was necessary, because of pupil absence or because one member of a group progressed more rapidly than the other.

Arithmetic for Low Achievers. This group was under teacher direction most of the time but with opportunities for team work each day, especially in computations. Low achievers were first tested informally to discover the nature of the difficulty. This led to several levels of instruction within this group. It was necessary for low achievers to master earlier learnings before beginning the arithmetic work of the grade. The general procedure for low achievers in arithmetic followed this pattern.

1. Children were taught concepts, understandings, and skills directly by the teacher.
2. Multi-sensory aids, i.e., film strips, flannel boards, manipulative and illustrative materials were used when available in a school.
3. Maximum utilization of intensive practice at points of weaknesses were stressed. This consisted of both teacher-led practice and practice and drill in teams of two and three.
4. Systematic review practice in weak combinations was accomplished by flash card drills in pairs. Each team made sets of flash cards for weak combination drill.
5. In the interest of the economy of time, every-pupil response techniques were utilized. Each pupil made a set of small flash cards with each number from one to ten written on them. The teacher dictated a problem, or fact practice, and each pupil responded by holding up the correct answer. This allowed every pupil to receive the practice, and the teacher was able to correct immediately any misconception or error. This technique replaced take-your-turn recitation and allowed each pupil to reap the maximum number of practices in drill situations.
6. The every-pupil response technique was also used in solving mental arithmetic problems dictated and led by the teacher.

Safeguarding the Arithmetic Program. Regardless of level, the arithmetic program was flexible and adapted to the learning needs of children within a classroom. Teachers were constantly supervising the arithmetic program, moving in and out of groups as necessary and checking the progress of individuals and teams by moving about the classroom. This was especially necessary to safeguard any "dragging" by one member of a team. No group was ever to be isolated from teacher control and supervision. Discipline and order were to be maintained at all times. The noise level of classrooms was higher than under whole-class type instruction, but constituted a working or low level of noise. Discipline problems were handled by having children work alone for the day.

Variations in Team Learning in Arithmetic. Re-grouping was necessary throughout the year. Many average achievers, when aware of the possibility of moving ahead more rapidly, were motivated to work with greater zeal. Many average achievers were regrouped as high achievers because of their desire to do more work and not be held down. After overcoming weaknesses, some low achievers were moved to the average group.

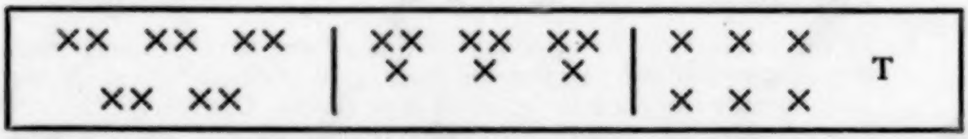
The procedures already described were departure points for teachers from whole-class type instruction. Variations from these procedures were encouraged as long as provision for learning needs were made.

Alternate job sheets were made by some teachers to serve as extra practice lessons for rapid achievers who had not mastered the learning through the job sheets, and for average achievers who possessed the necessary discipline to work alone yet required more practices than the high achiever group. Other teachers built five-day assignment sheets for slow learners toward the latter part of the school year. This proved a valuable incentive to low achievers.

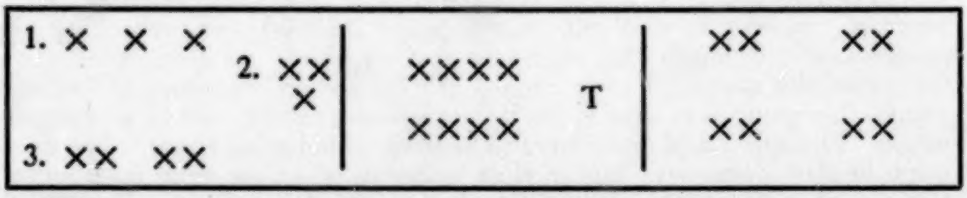
The sharing and exchange of materials among teachers in a school provided many opportunities for improved instruction and gave added impetus to the program.

Charts of Typical Groupings in Arithmetic. In order to get a picture of the many possibilities for team learning in arithmetic, charts of various groupings of pupils, according to tasks to be accomplished, are given below.

VARIOUS CLASSROOM ORGANIZATIONS FOR GROUPING PUPILS



High Achievers	*Average Achievers*	*Low Achievers*
Children work on job sheet, advancing through the various problems and understandings according to individual or paired rates of progress, get help from partner, utilize mutual assistance, ask teacher for help if necessary.	Children work on problem-solving examples in teams of three, utilize mutual assistance, immediate correction, ask teacher for help if necessary.	Teacher introduces (or reviews) skill to the group, gives illustrations, develops concept, uses every-pupil response technique for practice and drill. (It is possible that all members of group will not be ready for new skill. They will be assigned practice work.)



High Achievers	*Average Achievers*	*Low Achievers*
1. Children take tests alone, neither give nor receive help. 2. Another team solves written problems (may be team of two or three). 3. Team works on a job sheet, according to mastery advance from one job sheet to a more difficult one, completing the text of the grade at their own rate.	Every-pupil response in mental arithmetic, utilizing the maximum economy of pupil time, immediate correction of any errors.	Paired practice in systematic review of multiplication and division facts, multiplication facts for those needing it, division facts for those who need it. *or* Teacher assigns the written work for the day (or week), children may utilize mutual assistance if necessary, may check answers with each other.

Progress of Pupils in Arithmetic. When children were allowed to advance at their own pace in the arithmetic program, wider variations in pupil progress were noted as the study continued. As stated in Chapter 2, continuous progress, including advancing to the text of the next grade, was decided by the administration. On April 3, 1959, each teacher was asked to report on the pupil placement in the arithmetic textbooks. The following table is a summary of the pupil placement at that time. Grade levels are divided into halves by using symbols 4^1 and 4^2 to represent the first and second half of the text for grade four and the same symbols split arithmetic advancement in grades five and six.

TABLE 1

PUPIL PROGRESS IN THE TEXTBOOKS

	4^1	4^2	5^1	5^2	6^1	6^2	7^1	7^2
Grade Four								
Number	17	214	70	47	9			
Per Cent	5	61	20	13	1			
Grade Five								
Number			12	227	46	54	10	
Per Cent			4	65	13	15	3	
Grade Six								
Number					29	231	98	43
Per Cent					7	58	24	11

The per cent of pupils working in arithmetic textbooks above their grade level for grades four, five, and six were 34, 31, and 35 respectively. The average per cent of pupils working above the grade for all the intermediate grades was 33.

PROGRAM OF INSTRUCTION IN SPELLING

Textbooks and curriculum were controlled both years of the study. The spelling series used in the Dedham schools was *Using Words* series, Lillian E. Billington, Silver Burdett Company, 1945. To replace uniform instruction and utilize the spelling texts of the intermediate grades required constructing a program around the following objectives:

1. To provide for various levels of spelling ability.
2. To accommodate for differing rates of progress and mastery among children.
3. To provide intensive instruction at points of difficulty and help children overcome weaknesses.
4. To improve the transfer from studied spelling words to use in a child writing vocabulary.
5. To utilize self-direction and self-correction in the interest of the economy of both pupil and teacher time.
6. To enhance social aims through mutual helpfulness in learning.

A wide range of levels was present in every classroom. In order to determine levels, rates of progress, and special needs, each child was tested on learning rate, visual memory, phonetic spelling, and recognition of homophones. Adapting a spelling program to meet individual needs and transfer from uniform to individual instruction required that each of the following steps be taken:

1. Adapt the text to high, average, and low achievers.
2. Plan small team and independent activities.
3. Build progress charts to record pupil attainments.
4. Build sequential lessons to correct spelling difficulties.
5. Plan systematic review lessons to safeguard retention.
6. Provide opportunities for the transfer of spelling to writing.
7. Build personal spelling lists according to individual needs for each child in the class.

Three-Day Spelling Program. Since spelling textbooks alone constitute a small division of spelling power and growth, with very few opportunities for transfer to writing situations, several adjustments had to be made:

1. Many spelling book exercises appeared to be of little or no value for superior spellers and were therefore omitted.
2. Many spelling text exercises seem to have little or no relation to improving spelling and are better taught as separate skills. Exercises of this type, dictionary skills, syllablizing and alphabetizing words, and the use of diacritical marks were transferred to the reading skills program.
3. Oral spelling was discontinued as accepted practice as its value is questionable in building spelling power.

In view of these adjustments, the spelling period for all groups for two days each week was devoted to reading skills, i.e., word classification, applied phonics, and response to meaning exercises. The three remaining days were scheduled for introduction, word usage, and tests.

Spelling for High Achievers. Individualizing instruction in spelling entailed adjusting the text to allow for (1) high mastery and retention, (2) establishing rules and standards so that children could progress at their own rate by self-direction and self-correction, and (3) broadening the spelling program to include personal spelling lists and transfer of spelling to written work.

High achievers were grouped in teams of two. These pairs were initially assigned partners whose rates of progress would be comparable. Since high achievers knew both how to read words and their meanings, teacher-led introductions were omitted.

The procedure for high achievers is described as follows:

1. The team works together on each spelling list, read the words to each other, and Pupil A then reads the short story in the text which uses each spelling word in context. (Pupil B will read the story in the next lesson.)

2. Pupil A gives written test to B when B is ready to take it.
3. Pupil A corrects B's test using the text to check proper spelling.
4. Pupil B studies any word he misspelled, and is then retested by A on the misspelled word.
5. Pupil A then takes the test following the same procedure.
6. If either pupil misspells more than one word, he must study the words, and then take the complete test over again. No child is allowed to progress without complete mastery.
7. Every sixth lesson (a review unit) is omitted and replaced by a forty-word test on previously studied spelling words.
8. Each pupil keeps a personal spelling list. Any word misspelled in spelling or in related language activities is written on his list.
9. High standards of legibility and neatness are stressed. Written paper below teacher-made standards are copied over.
10. Each child keeps a record of his attainments in spelling on a progress chart. All tests are kept in a folder to aid the teacher in reporting pupil progress, report cards, etc.

Spelling for Average Achievers. Average achievers followed a similar pattern as the high achieving group. First, each new spelling lesson was introduced to the group and was teacher-led. The teacher put each word on the board, surrounded the word with meaning, illustrations, using the words in sentences, using an every-pupil response technique for word recognition and meaning. After the introduction of a new unit, team learning was implemented as the tasks to be done as they were best suited to team work. The procedure then consisted of the following:

1. Children in teams of three of like ability and progress rate, pre-test each other. Children who spelled all assigned words correctly on the pre-test are freed of further spelling tasks for the week and engage in other language arts activities as individual self-directing assignments in content subjects.
2. Children read the "use-in-content" story of the unit. Any mispronounced words are corrected by other members of the team.
3. Each team studies the words in the lesson.
4. Pupil A gives written test to B and C. B and C exchange papers and correct, using spelling text as a guide, then study corrections.
5. A retests B and C.
6. B then tests A and C (C being tested for a second time). This gives C double practice. A and B take turns at double practice in successive lessons.
7. Correction procedures same as 4.
8. Controlled progress is made possible by allowing children to advance at spaced intervals. This is done by grouping children in teams of three.

9. Personal spelling lists, review units, progress charts, and high standards of legibility and neatness follow the same pattern as outlined for high achievers.

Spelling for Low Achievers. Most of the teacher's time during spelling lessons was devoted to the low achieving group as they needed the greatest amount of teacher help. The first task was to adjust the number of words to be studied to the learning rate of the individual. This led to several smaller groups in the low achievers group. Some children could master only five words per week from the grade speller, and this was therefore their study load. Other children were so poor in spelling that they did not use the spelling text as it was too difficult, but rather, used remedial spelling lists comprising second- and third-grade spelling words. The program for low achievers in spelling is comprised of the following steps:

1. The teacher introduced the new words in the same manner as for average achievers.
2. Low achievers were not pre-tested. As the teacher wrote the word on the board, they copied the word on paper. The teacher supervised this writing, circulating among the children, making sure of correct copying from the chalk board.
3. Children were grouped and given special intensive instruction according to their special weaknesses. This led to direct teaching to overcome such difficulties as (1) lack of auditory perception of word elements, (2) faulty word pronunciation, (3) over-application of phonics, (4) low relationships of spelling to meaning and imagery allied to the word, (5) slow or careless handwriting, and (6) poor visual perception of the word.
4. Techniques used for this intensive teaching were (1) response to meaning, (2) every-pupil response, (3) ear for sound training, (4) visual memory lessons, (5) flash card drill, (6) word recognition practice, and (7) applied phonics instruction.
5. Systematic review practice, teacher-led, helped safeguard retention and meaning.
6. Team learning techniques were utilized when practice and drill tasks warranted pairs; however, the greater part of the spelling lesson was teacher-led.

Safeguarding the Spelling Program. Teacher supervision, moving in and out of teams, checking progress, maintaining high standards while circulating among the children, was the prime safeguard of the program. The teacher who could sit behind her desk and "keep an eye on things" was non-existent. Close, constant supervision was the key to the success of team learning in all subjects. Pairs were flexible and transfer and re-grouping was encouraged to allow optimum pupil progress. Variations on the described procedures were encouraged, as long as children's learning needs were served. The teacher was free to teach any child or any group when necessary, and no children were ever isolated from teacher control.

Progress and Adaptions in Spelling. Allowing children to progress at their own rate provided high motivation for children. High achievers completed the required spelling in four to seven weeks. Under whole class instruction, the spelling text would have lasted thirty-six weeks. Average achievers completed the spelling tests in fifteen to twenty weeks. Low achievers whose learning rate was from five to seven words per week, progressed to mastery of ten to fifteen words per week by the end of the year.

Re-grouping of children was necessary very often. Many average achievers became high achievers and completed the year's work in half the planned time.

Personal spelling lists became the key of the program. High achievers, having completed the text much sooner than anticipated, centered their attention on "collecting" twenty words each week (or two weeks) that they did not know how to spell, but needed in language arts writing, or in relation to science and social studies learning. High achievers tested each other on these collected words. Any words misspelled were put on their personal spelling list. These lists could be cleared monthly by taking a personal test. Incorrectly spelled words were never discarded but rather they were carried over to a new personal list until correct spelling was ascertained.

PROGRAM OF INSTRUCTION IN LANGUAGE ARTS

To individualize language instruction to meet learning needs of children was a complex task. Attempting to serve the needs and wide ability ranges by the use of a single level text was impossible. Many language activities were by their very nature incorporated in other subject areas. The specific areas of services to be rendered in language were outlining, creative writing, proofreading, usage, and mechanics of writing.

Outlining. Instruction to levels of ability required that outlining tasks be adopted to several levels of competency. Children were grouped according to these levels:

1. Finding the main topic of title.
2. Finding topics and sub-topics.
3. Finding topics, sub-topics, and details.

The procedure for outlining was as follows:

1. Children progressed through the three levels according to individual progress.
2. Children worked in teams of two and three to read the paragraph, individually composed their outline, then compared their product with the other members of the team.
3. Children kept records of their progress, and moved to higher levels of outlining as soon as they were ready.
4. As soon as the skill was firmly established, it was put to use in science and social studies projects.
5. Only factual, well-written material was used.
6. Teachers had much freedom in conducting lessons in outlining, as long as learning needs were cared for.

Grammar and Usage. During a language arts workshop, it was suggested that teachers examine the language text, isolate grammar and usage skills, and construct job sheets so that high and average achievers could advance through this skills learning according to individual or team rates. These job sheets were self-correcting and self-directing. Progress charts, rules, and standards, similar to those in arithmetic and spelling, were set up. Children worked on these job sheets in teams of two or three, giving mutual aid, sharing, and correcting lessons.

Children with special weaknesses were grouped together and taught by the teacher. Variations for this procedure were implemented. Some teachers did not use language usage "job sheets" but allowed children to work in pairs on grammar and usage lessons. Other teachers felt that high achievers did not need the grammar and usage lessons in the text, gave an end-of-year attainment test, and omitted these lessons for those children whose time would have been wasted doing these assignments.

Mechanics of Writing and Proofreading. Instruction in mechanics included punctuation, capitalization, correct usage, and sentence structure. The most important aspect of the language program was providing children with many opportunities to write. Large charts listing written standards were constructed and prominently displayed in every classroom.

These standards were built by the children. They included items such as (1) Does every sentence begin with a capital? (2) Does every sentence end with a mark of punctuation? (3) Does every sentence express a complete thought? (4) Are all words spelled correctly? etc.

All writing was done alone, grouping and teaching to weaknesses was done according to need. Children with poor sentence sense were grouped and received intensive instruction.

Proofreading was done in pairs, using the written standards as a guide, with children of high and average writing ability first reading and checking their own work, then exchanging their work with their partner and proofreading the partner's paper. Teachers handled this proofreading task in a variety of ways. Some teachers allowed children to point out each error to a partner, or, in the margin, abbreviate the type of error in the line, directing the children to find and correct the error himself. Other teachers directed the pupils to list errors found at the end of the composition, directing the child to "hunt and find" the error within the written material. This latter method could be used only with high achievers.

Group proofreading was done with low achievers in language and was teacher-led. One child would copy his story on the board, the group would read each standard from the large chart, and help correct any errors. One child would check punctuation, another capitalization, etc. The teacher would put as many different children's work on the board for group correction as time allowed.

Letter writing followed a similar pattern in proofreading. The language text served as a reference tool for correct letter forms. One rule was established to guide teachers in letter-writing activities. *Letter writing would be done only when there was a need and purpose; every letter that was written was to be sent or mailed.* Throughout the year there were many opportunities to write letters in conjunction with social studies and science activities.

Creative Writing. Creative writing received more attention and emphasis than any other language arts activity. Setting the stage for creative writing was the first step. This involved planning motivational situations that would lead children to the writing task, giving them freedom also to write stories on the impossible, the improbable, tall tales, comedy, surprise-ending stories, etc. Some of the motivational situations given to teachers to use were (1) four unrelated pictures, (2) skeletal outline, (3) four unrelated objects, and (4) a shoelace or piece of string.

The grouping patterns for creative writing were flexible. A flow chart of a typical creative writing lesson follows:

VARIABLE GROUPING FOR CREATIVE WRITING

1. Teacher introduces class to lesson in creative writing, assigns children to type of motivation.

2. Children discuss assignment in groups of five (of unequal ability) sharing ideas for creative writing. One child in each group serves as secretary, lists ideas. Each group reports to the entire class, exchanging ideas.

3. Children begin writing alone, then check paper for errors after they have completed story. The teacher reviews standards for proofreading after the writing is done.

4. Paired Proofreading

High and Average Achievers	*Low Achievers*
Children exchange papers, point out errors of partners, and make corrections immediately.	Teacher selects one paper, has child write story on board, and the group proofreads it together under the teacher's direction, according to standards for proofreading.

5. Children read their own stories to each other. Groups of three of unequal ability are utilized.

6. Teacher collects papers to check for errors that may have been overlooked by the children.

Creative writing lessons gave opportunity for children of unequal ability to work and share together and this was an important part of team learning. Further extensions of creative writing experiences were made by teachers and pupils alike. New ideas, motivational situations, and writing opportunities were invented by both teachers and children. These ideas spread, were shared by teachers in the same building, and carried to other buildings by the research team.

Writing was not limited to stories alone but included poems, plays, and dramatizations. In addition to planned lessons, many teachers provided children with writing booklets for their personal use. When children had spare time, and had a desire to create, they had their own little booklet.

PROGRAM OF INSTRUCTION IN READING SKILLS

Instruction in reading skills constitutes only a portion of the program to individualize instruction in reading. The use of reading in content subjects and appreciational reading are described in Chapter 4.

Prior to the initiation of this study, reading was by far the best taught subject in the Dedham schools. The basal reading for the Dedham schools was *The MacMillan Readers*, Arthur I. Bates and Jean Ayer, The MacMillan Company, 1940. No workbooks for this series were used in grades four, five, and six. Provision for two and three level groupings were evident in almost every classroom and the reading needs of children were served through group organization. There were, however, many opportunities to improve reading instruction and to give breadth and depth to the reading program. Many reading skills activities would be better handled through small group instruction.

The individualization of instruction in reading necessitated major changes in classroom organization in order to provide for children to work in teams of two and three at their own rates and under their own direction.

The objectives of the individualized program in reading were:

1. To allow children to develop skills and abilities commensurate with their level.
2. To allow high achievers to acquire the necessary reading skills according to individual rates of progress and to accommodate for their high level reading ability through independent, individual activities related to reading.
3. To adjust textbook lessons to fit the needs of slower learners, reduce the learning load, and make varied use of the basal.
4. To make maximum use of the economy of time in learning to develop exercises that are self-correcting and self-directing.
5. To enhance pupil self-discipline and initiative through individual and team study and mutual aid.

A series of informal tests helped determine instructional levels in reading. Each child was tested on (1) oral and silent reading, (2) comprehension, (3) oral and written recall, and (4) word analysis abilities. They were then grouped into high, average, and low achiever levels.

Team Learning for High Achievers in Reading. High achievers in reading ranged in ability from one to four years above grade level in both vocabulary and comprehension. To limit reading for this group to the basal reader would stifle and discourage the rapid learner. Consequently, this group was allowed to advance rapidly through the basal reader of the grade. For skills weaknesses, this group was brought together for intensive teaching, did practice and drill exercises in teams of two.

Since many of the related practices and drills in both the teacher's manual and the basal were unnecessary, emphasis was placed on comprehension. Children were allowed to read the basal at their own rate of speed. Systematic comprehension check tests were given by the teacher to assure maintenance of good comprehension. The knowledge that they could complete the text, and not be burdened with it for the entire year, gave added impetus to the program.

As soon as high achievers completed the text, they participated in the balanced independent reading program described in Chapter 4. This program, plus choral reading, play reading, and dramatization developed higher competence in oral reading abilities.

Team learning in word analysis abilities was accomplished through word classification lessons. These were designed to give intensive instruction at points of weakness, develop vocabulary and word meanings, and develop imagery and word usage practice. By working in teams of two, initiative was on the part of the learner rather than the teacher. This was a dual undertaking as materials were both self-directing and self-correcting.

Record keeping, progress charts, and tests scores were necessary adjuncts to individual progress.

Team Learning for Average Achievers. Average achievers used the basal reader of the grade for skills instruction three days each week. The other two days were devoted to the uses of reading, play reading, poetry, dramatization, choral reading, and independent reading which served to strengthen and further the development of oral reading practices.

In word analysis skills, pupil teams of two were utilized in word classification and direct word analysis practice. Teams progressed at their own rate, kept personal progress chart records, and changed teams if their progress became diverse.

Oral and written recall skills were taught in teams of three. Pupils were given selections to read, with questions to guide the reading. Each child read the material, then answered the questions with his partner.

Team Learning for Low Achievers. Most of the skills instruction for low achievers was teacher-led. The activities mentioned for average achievers were used in the same manner with low achievers, but at lower levels.

Grouping children of like difficulties for intensive teaching required the use of supplementary materials, both commercial and teacher-made. Additional teaching to the low achieving groups in intensive sequential lessons were:

1. Teaching letter names and letter sounds.
2. Teaching ear for sounds.
3. Applied phonics and response to meaning techniques.
4. Word classification lessons.

Opportunities for the slow learner to realize his progress was given through individual progress charts and records of attainments. This allowed for additional motivation for this group, as each child could see that he was making progress as the learning was made significant to him. Team learning techniques were utilized when practice and drill tasks warranted pairs, but the largest part of the reading skills program was teacher-led.

Pupil Progress in Reading. As in arithmetic and spelling, individual progress served as a high motivational technique. High achievers, for whom the basal reader would normally last the school year, completed the work of the grade in from four to nine weeks. Re-grouping was necessary as team techniques and individual progress further spread the range of individual differences.

Average and low achievers experienced a richer, broader reading program when adjustments to the basal reader program were made which included wider out-of-the-basal type reading of poetry, plays, and individualized reading. Most teachers devoted one day per week to individualized reading. The sharing of books read and other related materials of reading was done in teams of three with groupings of differing ability levels. This allowed for even the slowest of pupils to share their new-found experiences in reading with average and high achievers, and served as an excellent counterbalance to other reading tasks which had to be done according to ability groupings.

PLAN FOR EVALUATION OF THE PROGRAM

Experimental and Control Populations. This was a two-year study. The 1957–1958 school year being the control year and the 1958–1959 school year the experimental. All children and classrooms in the intermediate grades in the 1958 population made up the control group. All children and classrooms in the intermediate grades in the 1959 population made up the experimental group. Each teacher served as his own control. Although there were 47 intermediate classrooms in Dedham, there were only 35 classrooms that could be used in the study because of changes in teaching personnel. Only classrooms where teachers returned to the same school and grade could be used for the statistical analysis of the controlled population. Comparisons were based on achievement of pupils of these teachers before and after the program which adapted instruction to the learning needs of children was undertaken. These classrooms are referred to as "teacher-controlled" classrooms.

The intermediate-grade classroom population for the two years the study was conducted is presented in Table 2.

TABLE 2

TEACHER CONTROLLED POPULATION

	Grade 4		*Grade 5*		*Grade 6*		*Total*	
	1958	*1959*	*1958*	*1959*	*1958*	*1959*	*1958*	*1959*
Classrooms	12	12	9	9	14	14	35	35
Children	374	374	209	206	303	300	886	880

The Testing Program. The testing program consisted of three parts. All research instruments were administered by the research team and selected experienced school personnel who were familiar with the procedures and directions. The first testing took place in May 1958, when all tests were administered to pupils in grades four, five, and six. The second part of the testing program entailed administration of all the research instruments to the incoming fourth grade in September 1958. This was done to determine if the experimental year fourth grade was comparable in intelligence, achievement, and other factors to the 1958 fourth-grade population. The third and final part of the testing program was conducted in May 1959. This third testing consisted of all the research instruments excepting the intelligence test, which had already been administered to all children in the study in the first and second part of the testing program. All children in grades four, five, and six were tested in the third part.

The battery included:

1. Kuhlmann-Anderson Intelligence Test:[1] Form D for Grade Four, Form E for Grade Five, and Form F for Grade Six.
2. Metropolitan Achievement Test:[2] Grade Four, Elementary Form R, May and September 1958 and Form T, May 1959; Grades Five and Six, Intermediate Form R, May 1958, and Form T, May 1959.
3. A modified form of the Bogardus Social Distance Scale.[3]
4. A modified form of the subject preference rating used in the Chase[4] study.
5. A modified form of the Eldridge[5] scale to determine children's school adjustment.
6. An informal scale for parental rating of pupil reactions to school service, to determine parental satisfaction with school service.
7. An informal scale for measuring teacher's service to the learning needs of pupils.

Fuller description of the informal scales, subject preference, social distance, pupil adjustment, and parental satisfaction with school subjects may be found in Chapter 5.

Comparison Techniques. Each teacher served as his own control, so personality qualities, intelligence, educational background, and other factors which might relate to teaching success could be considered constant, and any major change would be in the service to the learning needs of pupils.

The pupils were drawn from the same population both years. Socio-economic status, home emphasis on education, parental attitudes toward school, and other community and home factors affecting pupil achievement would be approximately the same.

No changes were made in general administrative and supervisory practices, time schedules, curricula, or basic textbooks during the two years of the study and the local emphasis was similar.

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[1] *Kuhlmann-Anderson Intelligence Test.* Personnel Press, Inc., Princeton, New Jersey, 1952.

[2] *Metropolitan Achievement Test.* World Book Company, Yonkers-on-Hudson, New York, 1946.

[3] Joseph A. Gattuso, et al., "An Evaluation of Curriculum-Related Specialties in Grades Five and Six, 2 Vols. (Unpublished Master's thesis, Boston University, Boston, 1957.)

[4] W. Linwood Chase, "Subject Preferences of Fifth Grade Children." *Elementary School Journal* (December, 1949), 50:204–211.

[5] Olive F. Eldridge, "The Construction and Validation of an Instrument to Measure Classroom Adjustment." (Unpublished Doctor's thesis, Boston University, Boston, 1957.)

Teacher Service to Learning Needs of Children. Chapter 2 describes the evaluation of teaching services to pupils and the comparison of services for both years of the study. A break-down of the mean ratings for the thirty-five teacher-controlled classrooms and the highest possible score in each skills subject is given in Table 3.

TABLE 3

MEAN RATINGS OF TEACHER SERVICE TO PUPILS IN SKILLS SUBJECTS

Subject	*1958*	*1959*	*Lowest Possible Score*	*Highest Possible Score*
Reading	6.90	14.66	5	20
Spelling	4.63	12.40	4	16
Language	6.09	9.80	5	20
Arithmetic	5.34	12.85	4	16

Evidence of Equal Ability of Pupils: 1958 and 1959. Comparisons of chronological ages of pupils were made at the three grade levels, four, five, and six, for both the 1958 and 1959 populations. The mean differences in chronological age (in months) were .03, .69, and .28 for grades four, five, and six, yielding critical ratios of .06, 1.33, and .69 respectively, showing no statistically significant differences between control and experimental populations.

Evidence of equal ability of pupils in I.Q. are given in Table 4.

TABLE 4

INTELLIGENCE QUOTIENTS 1958 vs. 1959

	Grade 4		*Grade 5*		*Grade 6*	
	1958	*1959*	*1958*	*1959*	*1958*	*1959*
N	294	280	241	187	313	335
Mean	106.57	106.70	107.45	106.93	109.79	108.57
S.D.	11.19	11.07	11.40	10.78	12.32	11.84
SE_m	.65	.66	.73	.79	.70	.65
Difference	.13		.52		1.22	
$SE_{Diff.}$	.92		1.31		1.16	
Critical Ratio	.14		.40		1.28	

Comparison of mean I.Q. scores show differences of .13 and .52 for grades four and five, and in grade six the control group is favored by 1.22 points of I.Q. However, no grade shows statistically significant differences.

FINDINGS

Achievement Comparisons: 1958 vs. 1959. Table 5 compares arithmetic fundamentals in 1958 with those of 1959.

TABLE 5

ARITHMETIC FUNDAMENTALS

	Grade 4		*Grade 5*		*Grade 6*	
	1958	*1959*	*1958*	*1959*	*1958*	*1959*
N	294	280	241	187	313	336
Mean Score	179.70	178.59	206.36	213.27	229.90	231.20
Gr. Equiv.	5.5	5.4	6.5	6.8	7.5	7.6
S.D.	12.45	14.03	21.21	24.83	22.35	23.02
SE_m	.73	.84	1.37	1.81	1.26	1.26
Difference	—1.11		6.91		1.30	
SE_{Diff}	1.11		2.27		1.59	
Critical Ratio	1.00		3.04		.73	

In arithmetic fundamentals, only grade five showed a statistically significant improvement over 1958. There was a slight improvement in grade six, a slight loss in grade four.

Achievement in arithmetic problem solving is compared in Table 6 for 1958 and 1959.

TABLE 6

ARITHMETIC PROBLEMS

	Grade 4		*Grade 5*		*Grade 6*	
	1958	*1959*	*1958*	*1959*	*1958*	*1959*
N	294	280	241	187	313	336
Mean Score	186.30	186.29	202.74	213.80	219.27	226.95
Gr. Equiv.	5.6	5.6	6.7	7.5	7.9	8.7
S.D.	15.07	12.96	24.08	23.79	20.91	23.39
SE_m	.88	.77	1.55	1.74	1.18	1.28
Difference	.01		11.06		7.68	
SE_{Diff}	1.17		2.33		1.57	
Critical Ratio	.01		4.75		4.41	

Both fifth- and sixth-grade children showed gains of 8 months in terms of grade equivalent scores, favoring the experimental group; fourth grade showed identical scores. Critical ratios of 4.75 and 4.41 for grades five and six respectively, show significant gains favoring the experimental group.

Table 7 compares spelling standard scores of 1958 with those of 1959.

TABLE 7

SPELLING

	Grade 4		*Grade 5*		*Grade 6*	
	1958	*1959*	*1958*	*1959*	*1958*	*1959*
N	294	280	241	187	313	336
Mean Score	187.41	192.60	199.57	205.93	210.29	214.15
Gr. Equiv.	5.7	6.3	6.4	6.8	7.1	7.4
S.D.	20.28	21.18	20.80	21.77	21.14	21.24
SE_m	1.18	1.27	1.34	1.59	1.19	1.16
Difference	5.19		6.36		3.86	
SE_{Diff}	1.73		2.08		1.53	
Critical Ratio	3.00		3.06		2.33	

The program of differentiated instruction in spelling resulted in statistically significant gains in all grades. The improvements in terms of grade equivalents were 6, 4, and 3 months for grades four, five, and six respectively.

Average reading scores for 1958 are compared with 1959 in Table 8.

TABLE 8

AVERAGE READING

	Grade 4		*Grade 5*		*Grade 6*	
	1958	*1959*	*1958*	*1959*	*1958*	*1959*
N	294	280	241	187	313	336
Mean Score	188.00	187.33	201.87	202.94	209.40	216.20
Gr. Equiv.	5.8	5.7	6.7	6.8	7.4	8.2
S.D.	21.04	20.57	20.58	20.68	20.22	21.32
SE_m	1.23	1.23	1.33	1.51	1.14	1.16
Difference	.67		1.07		6.80	
SE_{Diff}	1.74		1.54		1.52	
Critical Ratio	.39		.69		5.31	

Grade six showed a gain of 8 months in grade equivalent score, yielding a significant critical ratio of 5.31 favoring the experimental year. Grade five showed a slight gain, grade four, a slight loss.

Reading vocabulary scores for 1958 and 1959 are given in Table 9.

TABLE 9

READING VOCABULARY

	Grade 4		*Grade 5*		*Grade 6*	
	1958	*1959*	*1958*	*1959*	*1958*	*1959*
N	294	280	241	187	313	336
Mean Score	191.00	190.45	203.11	202.36	210.21	215.28
Gr. Equiv.	6.0	5.9	6.7	6.7	7.5	8.1
S.D.	21.51	20.32	22.15	21.64	22.20	21.46
SE_m	1.25	1.21	1.43	1.51	1.25	1.17
Difference	.55		.75		5.07	
SE_{Diff}	1.72		2.08		1.56	
Critical Ratio	.32		.36		2.96	

Grade six showed a gain of 6 months in grade equivalent score, a statistically significant improvement over 1958. Both grades five and four showed slight losses.

Comparison of reading comprehension scores of 1958 and 1959 are given in Table 10.

TABLE 10

READING COMPREHENSION

	Grade 4		*Grade 5*		*Grade 6*	
	1958	*1959*	*1958*	*1959*	*1958*	*1959*
N	294	280	241	187	313	336
Mean Score	186.43	184.09	200.71	202.75	208.26	216.04
Gr. Equiv.	5.6	5.4	6.7	6.9	7.3	8.2
S.D.	20.15	23.89	21.88	21.29	19.68	21.70
SE_m	1.17	1.43	1.41	1.56	1.11	1.18
Difference	—2.34		2.04		7.78	
SE_{Diff}	1.85		2.10		1.51	
Critical Ratio	1.26		.97		4.80	

In reading comprehension, grade six showed a gain of 9 months in grade equivalent score, yielding a significant critical ratio of 4.80. Grade five showed a slight gain, grade four a loss.

In language arts, the Metropolitan Achievement Test for English is confined to a grammar-usage test for grade four, and grammar-usage and punctuation for grades five and six. Table 11 compares English scores in 1958 with those of 1959.

TABLE 11

ENGLISH

	Grade 4		*Grade 5*		*Grade 6*	
	1958	*1959*	*1958*	*1959*	*1958*	*1959*
N	294	280	241	187	313	336
Mean Score	193.13	192.73	202.68	206.73	211.31	218.42
Gr. Equiv.	6.1	6.1	6.7	7.1	7.4	8.2
S.D.	22.24	19.17	23.63	22.16	21.84	22.62
SE_m	1.30	1.15	1.52	1.62	1.23	1.23
Difference	.40		4.05		7.11	
SE_{Diff}	1.73		2.22		1.57	
Critical Ratio	.23		1.82		4.09	

Grade six shows a gain of 8 months in terms of grade equivalent scores, with a critical ratio of 4.09 which is highly significant. A gain of 5 months in grade five yields a critical ratio of 1.82 and approaches significance. However, grade four shows a slight loss.

Growth in Achievement of Experimental Pupils. The achievement test battery was given to grade four in September 1958 and May 1959 in order to measure gains of the same pupils in each subject during the school year. Table 12 compares average achievement gains in each skills subject.

TABLE 12

GROWTH IN ACHIEVEMENT OF EXPERIMENTAL PUPILS: FOURTH GRADE

	Sept. 1958		*May 1959*		
	Mean Score	*Gr. Equiv.*	*Mean Score*	*Gr. Equiv.*	*Gain (Years)*
Av. Reading	170.09	4.6	186.32	5.6	1.0
Av. Arith.	160.57	4.3	181.96	5.5	1.2
English	173.16	4.6	191.43	5.9	1.3
Spelling	171.56	4.7	191.99	5.9	1.2
N = 345					

With a mean I.Q. of 106 the expected gain for this group would be 1.0 for the nine months. September to May growth exceeded this expectancy by 2 months in arithmetic and spelling and by 3 months in English, with reading showing the normally expected gain.

Table 13 shows the achievement growth of children in grade five from May 1958 to May 1959.

TABLE 13

Growth in Achievement of Experimental Pupils: Grade Five

	May 1958		*May 1959*		
	Mean Score	*Gr. Equiv.*	*Mean Score*	*Gr. Equiv.*	*Gain (Years)*
Rdg. Vocab.	191.00	6.0	202.36	6.7	.7
Rdg. Comp.	186.43	5.6	202.75	6.9	1.3
Arith. Fund.	179.70	5.5	213.27	6.8	1.3
Arith. Prob.	186.30	5.6	213.80	7.5	1.9
English	193.13	6.1	206.73	7.1	1.0
Spelling	187.41	5.7	205.93	6.8	1.1
N = 187					

With a mean I.Q. of 106.9, the expected growth for this group would be 1.1 for the period covered. The growth exceeded this expectancy in reading comprehension and arithmetic fundamentals by 2 months, in arithmetic problems by 8 months. In English they were one month below expectancy and in reading vocabulary four months below.

Table 14 shows the achievement growth of children in grade six from May 1958 to May 1959.

TABLE 14

Growth in Achievement of Experimental Pupils: Grade Six

	May 1958		*May 1959*		
	Mean Score	*Gr. Equiv.*	*Mean Score*	*Gr. Equiv.*	*Gain (Years)*
Rdg. Vocab.	203.11	6.7	215.28	8.1	1.4
Rdg. Comp.	200.71	6.7	216.04	8.2	1.5
Arith. Fund.	206.36	6.5	231.20	7.6	1.1
Arith. Prob.	202.74	6.7	226.95	8.7	2.0
English	202.68	6.7	218.42	8.2	1.5
Spelling	199.57	6.4	214.15	7.4	1.0
N = 336					

With a mean I.Q. of 108, the expected growth of this group of pupils would be 1.1 for the period covered. The growth in achievements in reading vocabulary exceeded this expected growth by 3 months, in reading comprehension by 4 months, in arithmetic problems by 9 months, in English by four months. In arithmetic fundamentals they met the expected growth, and in spelling they were one month below the expected growth.

Comparison of Achievement by I.Q. Levels. In order to determine achievement differences for average, bright, and slow children, the population was divided into the following I.Q. levels: (1) I.Q. 120 and above, (2) I.Q. 96 to 119, and (3) I.Q. 95 and below.

Table 15 compares the achievement of pupils in 1958 with those of 1959 with I.Q.'s of 120 and above.

TABLE 15

ACHIEVEMENT SCORES, I.Q. 120 AND ABOVE
(GRADE EQUIVALENTS)

	Grade 4			*Grade 5*			*Grade 6*		
	1958	*1959*	*Gain*	*1958*	*1959*	*Gain*	*1958*	*1959*	*Gain*
Av. Reading	7.1	7.4	.3	8.8	8.1	—.7*	9.4	10.4	1.0*
Arith. Fund.	5.8	5.9	.1	7.1	7.4	.3*	8.3	8.3	0
Arith. Prob.	6.1	6.0	—.1	8.1	8.9	.8*	9.4	10.6	1.2*
English	7.2	7.2	0	8.6	8.4	—.2**	9.7	10.9	1.2*
Spelling	6.7	6.7	0	7.4	7.6	.2	8.0	8.6	.6*
N =	23	33		35	16		70	58	

* Significant at .01 level.
** Significant at .05 level.

Children with I.Q.'s of 120 and above appeared to benefit in several subjects by the program of differentiated instruction. However there were losses in reading and English in grade five. Significant gains in grade five were in arithmetic; in grade six they were found in reading, arithmetic problem solving, English, and spelling. No significant improvement resulted in grade four.

Table 16 compares the achievement of children with I.Q.'s between 96 and 119.

TABLE 16

ACHIEVEMENT SCORES, I.Q. 96 TO 119
(GRADE EQUIVALENTS)

	Grade 4			*Grade 5*			*Grade 6*		
	1958	*1959*	*Gain*	*1958*	*1959*	*Gain*	*1958*	*1959*	*Gain*
Av. Reading	6.0	5.9	—.1	6.8	7.3	.7**	7.4	8.3	.9*
Arith. Fund.	5.6	5.5	—.1	6.6	7.0	.4*	7.5	7.6	.1
Arith. Prob.	5.9	5.7	—.2	6.8	7.8	1.0*	7.9	8.7	.8*
English	6.4	6.1	—.3	6.8	7.4	.8*	7.3	8.3	1.0*
Spelling	5.9	6.1	.2**	6.5	7.0	.5*	7.1	7.4	.3**
N =	222	202		174	144		208	237	

* Significant at .01 level.
** Significant at .05 level.

This group made significant gains in grades five and six in all subjects except arithmetic fundamentals in grade six. Grade four showed slight losses in all scores except spelling, in which the gain was significant at the 5 per cent level.

The achievement scores of children with I.Q.'s of 95 and below are compared in Table 17.

TABLE 17

ACHIEVEMENT SCORES, I.Q. 95 AND BELOW (GRADE EQUIVALENTS)

	Grade 4			*Grade 5*			*Grade 6*		
	1958	*1959*	*Gain*	*1958*	*1959*	*Gain*	*1958*	*1959*	*Gain*
Av. Reading	4.2	4.4	.2	4.8	4.9	.1	5.1	5.8	.7
Arith. Fund.	4.8	4.7	—.1	5.6	5.7	.1	6.4	6.6	.2
Arith. Prob.	4.6	4.9	.3	5.1	5.8	.7*	6.2	6.5	.3
English	4.3	4.8	.5	4.6	4.9	.3	5.2	5.8	.6
Spelling	4.3	5.0	.7*	4.8	5.1	.5*	5.1	5.5	.4
N =	47	45		32	27		35	41	

* Significant at .01 level.

All gains favor the 1959 group, except for arithmetic fundamentals in grade four which show a slight loss. Although gains favor the experimental group, significant differences are noted only in arithmetic problems and spelling in grade five and spelling in grade four.

Sex Differences in Growth in Achievement in Differentiated Instruction. Do boys or girls benefit more by differentiated instruction? Although boys and girls were closely alike in chronological age and I.Q. at each grade level, differences in achievement are reported in Table 18.

TABLE 18

MEAN GAINS OF BOYS AND GIRLS (IN STANDARD SCORES)

	Grade Four			*Grade Five*			*Grade Six*		
	Boys' Gains	*Girls' Gains*	*Dif.*	*Boys' Gains*	*Girls' Gains*	*Dif.*	*Boys' Gains*	*Girls' Gains*	*Dif.*
Av. Reading	1.31	—2.42	3.73	2.92	—.99	3.91	5.96	7.80	1.84
Rdg. Vocab.				1.78	—3.46	5.24	4.14	6.15	2.01
Rdg. Comp.				4.35	—.53	4.88	2.38	9.08	6.70
Av. Arith.	.04	—1.43	1.47						
Arith. Fund.				7.32	5.40	1.92	1.03	3.80	2.77
Arith. Prob.				13.94	8.03	5.91	5.05	10.37	5.32
English	2.09	—2.42	4.51	7.01	—.84	7.85	5.11	10.12	5.01
Spelling	7.24	3.63	3.61	8.43	2.42	6.01	1.72	6.74	5.72
N = (1958)	137	157		127	114		148	165	
(1959)	136	144		78	109		174	162	

In grade four, boys made greater gains than did girls under differentiated instruction; boys' gains exceeded girls' in all subjects in grade five; however, the reverse is true in grade six where girls made greater gains than did boys in all subjects. Apparently no conclusions can be drawn in regard to sex differences in improvement of achievement under differentiated instruction.

SUMMARY OF FINDINGS

After a year's program of differentiated instruction in thirty-five intermediate-grade classrooms, the resulting achievements were compared with those of pupils under the same teachers at the end of the previous year. The following findings are presented in relation to changes in achievement in skills subjects:

1. The program of differentiated instruction in grade four produced a statistically significant improvement over the previous year only in spelling; in other subjects there were no significant changes.
2. In grade five, the program produced improvements in all subjects; these gains were statistically significant in three of the six measures.
3. Grade six showed marked improvement under differentiated instruction; the improvements were statistically significant in five out of six measures.
4. The differentiated program in arithmetic produced statistically significant gains in problem solving in grades five and six. In computation skills there was a statistically significant gain in grade five, a slight gain in grade six. Grade four showed no change in problem solving, a slight loss in computation.
5. Spelling responded with statistically significant improvements over the previous year in all grades.
6. The program in reading produced statistically significant improvement only in grade six.
7. In English (grammar-usage-punctuation) grade six improved significantly; grade five made a mean improvement of five months.
8. Children with I.Q.'s of 120 and above made marked improvement under the differentiated instructional program in reading, arithmetic problem solving, English, and spelling in grade six. Fifth-grade children of this I.Q. level made gains in arithmetic problem solving, computation skills, and spelling; however, there were significant losses in reading and English.
9. Children with I.Q.'s between 96 and 119 in grades five and six appeared to benefit greatly by the differentiated program. They made statistically significant gains in all subjects except arithmetic fundamentals in grade six. In grade four, however, this I.Q. group showed small losses in all subjects except spelling.

10. The children with I.Q.'s of 95 and below made gains in all subjects in all grades, except arithmetic computation in grade four. However, only three of the subject differences were statistically significant.

11. Boys made greater improvement than girls in all subjects in grades four and five; the reverse was true in all subjects in grade six.

12. The program of differentiated instruction produced growth in achievement greater than the normally expected gains for the I.Q. level in all subjects in grade four, in all but reading vocabulary and English in grade five, and all except spelling in grade six.

Chapter 4

DIFFERENTIATING INSTRUCTION IN THE CONTENT SUBJECTS IN THE INTERMEDIATE GRADES

JOHN C. MANNING

I. PURPOSE OF THE STUDY

This chapter is specifically concerned with those changes in teacher service to pupils in the content areas of social studies, literature, and science. In effect, this study attempted to measure pupil growth in achievement as a result of a program of individualized instruction which emphasized adaptations to varying levels of ability, to differing rates of progress, to special skills weaknesses, to the need for self-initiative, and to enrichment possibilities. The program which attempted to provide classroom service to these needs directly followed the skills program cited in the previous chapter. Though concerned with specific subject areas, the program outlined here was an integral phase of the Dedham intermediate grade program.

II. SERVICE IN THE CONTENT SUBJECTS

The evaluation of the teacher services to pupils in the content subjects prior to this program has been discussed in Chapter 2. The results of this evaluation indicated a rather uniform approach to teaching the content subjects with only occasional enrichment services. The need for some means of adapting instruction in those subject areas was clearly apparent.

III. THE SOCIAL STUDIES PROGRAM

It was understood that no marked changes would be made in educational materials during the course of the one-year study. The geography textbooks and the history textbooks, Rand McNally series, grades four, five, and six, were used in the study as they had been previously used in the Dedham schools. These textbooks served as the basic instructional tools for the purposes of the program. How these textbooks were suited to individual needs and adapted for classroom use is the subject of this section.

By late October the skills subjects phases of the program were operating efficiently. Attention was now directed to the content subject areas. The initial work of dividing the textbook into chapter units with some degree of similarity between the geography lesson and history lesson was accomplished. This necessitated some rearrangement of the sequential order of chapters; likewise, it required some diligent efforts toward methods of adapting one text to the differing abilities of pupils within the same grade. Several efforts were required to accomplish the task of individualizing this content subject area.

Methods of Individualizing Instruction for Superior Learners. Though acceleration and rapid progress rate are allowable in the skills subject areas, no such accommodation can sensibly be made with content subjects. Certain learnings, which are the result of interchange of ideas and social relationships within the classroom, are a necessary part of social studies instruction. Though skills learning is necessary in this area, many other attendant enrichment activities require all students to be studying common subject matter. It was necessary, therefore, to devise some method of allowing bright youngsters to cover the assigned material in an efficient manner, yet allowing maximum opportunity for self-direction and initiative wherever possible. For this purpose advanced study guides were produced.

The first step in the development of adequate guide material was the presentation of a town-wide demonstration to show the effectiveness of advanced study guides using team-learning techniques. This was accomplished in early November 1958. At this meeting sample guides were distributed along with assigned chapters for the development of needed materials. Each grade in each building was arbitrarily assigned a chapter in the text from which a comprehensive study guide for bright pupils was to be developed.

The guide prepared by the experimenter was demonstrated under critical evaluation of the teachers. Different types of questions and activities were added to a master list distributed to the teachers for their use in compiling their assigned study guide. The purpose of these self-directing guides was to allow talented students to cover the assigned material at their own speed, yet be able to acquire enrichment possibilities from the teacher and share their knowledges with slower youngsters studying the same material.

Once the sample guide was demonstrated, the teachers began to prepare guides which could be shared by other teachers in other buildings. In all, forty-four such guides were developed, mimeographed, and distributed to Dedham pupils. The publication and distribution of these guides required a month of concerted effort by the office staff of the superintendent of schools.

During November and December work progressed on the development of these guides. Daily school meetings were held to proofread and evaluate each guide before distribution. The earliest guides were in use by the third week of November. Subsequent guides were published until all the grade texts were adequately covered. The final study guides were distributed in January 1959.

These advanced study guides were characterized by many different activities and learning situations.

1. "How" and "why" discussion questions.
2. Encyclopedia and reference reports (oral and written).
3. Project assignments in map making, charts, etc.
4. Outlining of textbook fact content.
5. Written summary reports.

In much the same manner as the skills subjects, daily history and geography demonstrations were given. The intelligent use of the study guide was the initial phase of this program. Teams of three to five students worked on each guide, group leaders were utilized, reports assigned, discussions held; the entire guide program was directed toward more independent work on the part of superior students. At any time, however, the teacher could interrupt the independent activity to discuss a common problem, to share ideas, or to present an enrichment activity. Most often the superior students would work alone or in small groups; it was not uncommon, however, to find them heterogeneously grouped with inferior students for discussion purposes. As in the other subjects of the program, flexibility of organization was an ever-present byword.

The study guides were further characterized by a large amount of reference study. Outside materials, encyclopedia, and library resources were utilized to add greater scope to each topic. A complete program of pupil specialties (comprehensive audio-visual reports) was organized. This program will be discussed in a later section. In all, the responsibility for self-direction and individual initiative was heavily placed on the superior students. It was felt that the disciplines of good study habits, social exchange, and pride in scholarship could best be developed using this individual approach to the factual knowledges of social studies. It was further concluded, however, that many other social learnings were necessary for an adequate program; for this reason, acceleration was not permitted. The scope and depth of the assigned subject became the quantitative measure of superior students.

It should be emphasized, however, that the administration of the advanced study guides was a matter of the personal preference of the teacher. In the daily school meetings, departure from the basic guide was encouraged. Teachers were allowed to add or delete activities from the guides to suit individual needs or to accommodate newly discovered interests. The use of the guides, though encouraged, was not a requisite for a successful program; it might be added, however, that all teachers used the guides.

The activities and responsibilities of the program for superior students might be capsuled as follows:

1. Small group team-learning activities using advanced study guides with the basal text, supported by advanced reading of a reference nature.
2. Classroom participation in all discussion or sharing periods.
3. Specialty reports, either individual or team, assigned in advance of the date when they would fit into the subject under consideration.
4. Review activities, accomplished in pairs.
5. Special teacher instruction in skills pertaining to social studies; map reading, time and distance skills.

Methods of Individualizing Instruction with Students of Average Capability. It was anticipated that some average pupils might, under certain favorable conditions, be able to use the advanced study guide. It was further determined, however, that overdependence on study guides might give a false security to the program. Though the use of the advanced study guide with this group was not prevented, it was discouraged.

In most instances, individual teachers compiled study guides of a simple or informal nature for these average pupils. These guides were less abstract than the advanced guides and were used as an adjunct to the main program. Team-learning techniques were used in the completing of these guides by the students.

The study guides used with this average group contained examples of the following activities:

1. Completion type exercises.
2. Fact outline exercises.
3. Group map exercises.
4. Classification exercises for review.
5. Small group reading activities.

The main emphasis with this average group was on the pupil acquiring greater skill in the intake of ideas and subsequent recall skills. Take-your-turn reciting procedures were eliminated and small group learning activities were substituted.

Many study guides were prepared for this group; specialty reports of a small group nature were also used effectively. Vocabulary aids, especially word classification cards, were often utilized. Systematic reviews using every-pupil response cards were often employed.

Though the textbook served as the basic instructional material, excellent library resources were also utilized with this group. The advanced study guide used by the superior students resulted in added time for the teacher to concentrate on the average group.

The program of individualization for these pupils is briefly summarized:

1. Teams of two or three use study guide with basic text.
2. Participation in discussion, pupils of equal or unequal ability in groups of three to five.
3. Systematic fact and concept review, teams of two using word classification or review cards.
4. Specialty reports, generally in teams, assigned in advance of presentation.
5. Emphasis on skills training and greater teacher direction in the learning activities.

Methods of Individualizing Instruction for Low Achievers. There was no question that the social studies materials in use were too difficult for the individual pupils in this group. Definite adaptation of the material was necessary.

This adaptation was accomplished by:

1. Increased emphasis on the vocabulary development.
2. Elimination of paragraphs in the text which were nonessential or generally abstract in nature.

3. Minimum essential fact content presented in outline form.

4. Oral presentation by the teacher.

5. Increased direction in discussion periods.

6. Substitution of activity work; map making, model building, and assisting in specialty presentation.

These adaptations in no way implied less participation in the class activities by the group, rather, it meant the sensible approach to modifying the text or eliminating it as the need appeared.

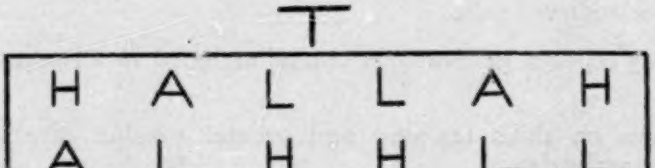
Children in this group tend to learn more through auditory means; their participation, therefore, in all whole class activities was essential. Contrary to what might popularly be assumed, these children were excellent participants in all discussion periods and tended to excel in the activity periods, especially in the preparation of models and dramatic presentations.

IV. THE SOCIAL STUDIES PROGRAM IN OPERATION

The charts which follow indicate the sequential development of a unit of study and show organizational patterns of the various groups in the learning process.

T........................Teacher
H........................High Achiever
A........................Average Achiever
L........................Low Achiever

The initial classroom organization for a unit in history might look something like this:



T

H	A	L	L	A	H
A	L	H	H	L	L
A	L	A	A	A	H
H	A	L	H	A	L

Figure 1. The class would be heterogeneously grouped for the introductory remarks by the teacher. This organization is also used for the hearing of specialty reports, dramatic readings, enrichment activities of various kinds, and for any whole class situation the teacher desired to create.

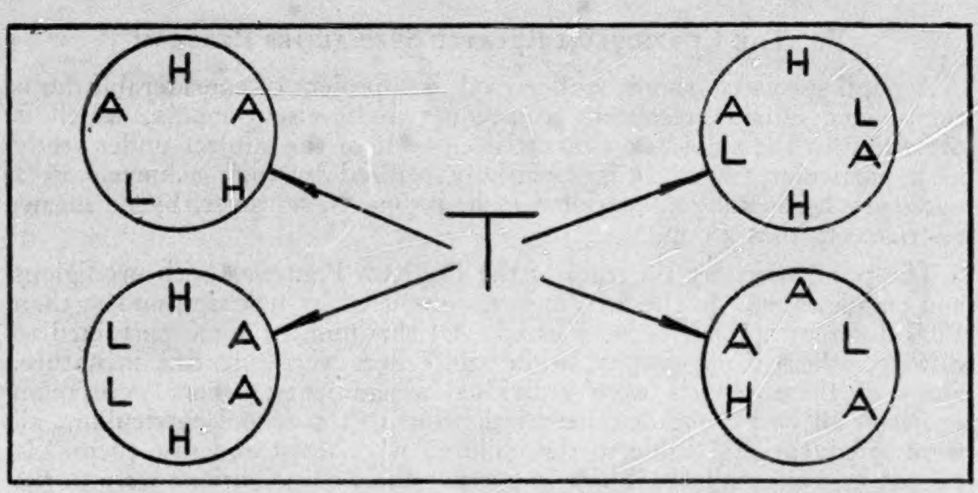


Figure 2. This organizational pattern was used in pupil planning activities or in discussion periods where heterogeneity is desired. This pattern necessitates the teacher's constant attention to the needs of each group; she circulates among the groups giving assistance, encouragement, or criticism where needed. This pattern is very favorable for low achieving pupils as it affords listening opportunities and allows them to participate in the oral language phases of the program.

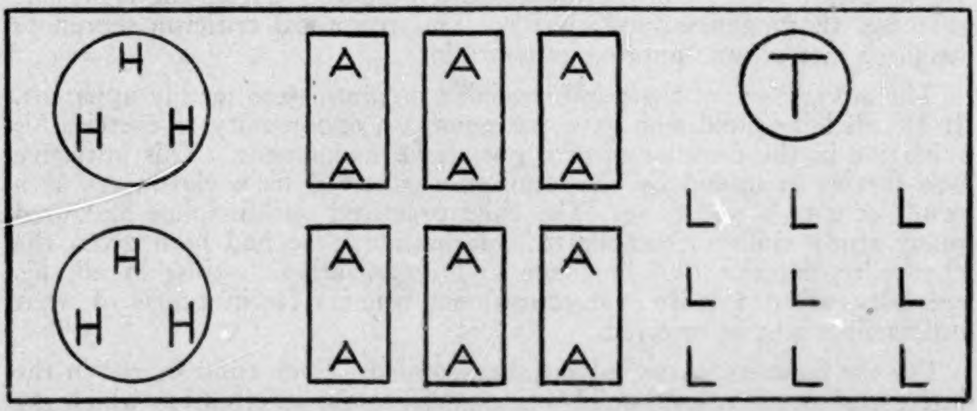


Figure 3. This organizational pattern and the many variations it allows shows the high achievers working in three's on advanced study guides. The average achievers are using paired practice in review activities, while the low achievers receive direct vocabulary help from the teacher.

Combinations and variations of the simple patterns illustrated above were heavily employed by most teachers. The organization was extremely flexible, depending for its pattern on the purpose of the lesson or the needs of the learners. It was stressed that no stable patterns existed; the degree to which the teacher departed from uniform instruction determined the composition of the groups.

V. THE CURRICULUM RELATED SPECIALTIES PROGRAM

A pupil specialty, simply understood, is a project of considerable duration, using outside resources, combining audio-visual media, which is presented to the class as an essential element of the subject under study at a particular time. It is essentially utilized by high achievers as a necessary broadening educational task; its use is, however, by no means restricted to that group.

The pupil specialty program of the Dedham Plan was both prodigious and enlightening. In the final reports submitted by teachers, no less than 1200 different specialties were listed. Of this number some pertained to history, others to geography, while still others were scientific in nature. Some of these reports were individual assignments, others were team projects, all bore some definite relationship to the school curriculum; all were of educational value to the children who heard and saw them. It cannot be overemphasized how important these contributions were to the total program.

Generally, these reports were limited to ten minutes' duration. This restriction was enforced to eliminate much verbalism which might not have any learning value. Pupils were constantly encouraged to use audio-visual materials to present their topic effectively; such materials could then be left for further study by the class at other times.

To prevent the specialties program from becoming a talking-hearing situation only (though in most cases this precaution was unnecessary), a testing period followed the report. This test, either oral or written, queried the listeners; they, in turn, evaluated the presentation from the viewpoint of poise, thoroughness, and clarity. This reciprocal criticism served to heighten interest and improve presentations.

The advantages of the pupil specialty program were readily apparent. It afforded the child who gave the report an opportunity to exercise his initiative in the completion of a purposeful assignment. This initiative was further rewarded by the admiration received from classmates as a result of a task well done. The child practiced self-discipline and used many study skills to compile his information. He had been given the chance to practice oral language and organizational skills; in all, his specialty afforded individual educational benefits far in excess of what ordinarily might be received.

For the listeners, many advantages accrued. Each child shared in the interest of another, each child was exposed to the information which the reporter collected. All the children benefited from seeing the techniques of presentation, and new interest areas were opened. Such reports were likewise a refreshing change from textbook mastery.

The poor reader, especially, benefited from such a program. Hampered by the lack of reading skills and thwarted in his attempts to pursue an interest by his reading disability, he found, in the specialty, auditory satisfaction and an excellent avenue to knowledge.

This integral phase of the program afforded many children opportunities for new knowledge. Specialties of particular merit, and there were literally hundreds, were shared among classes and among schools. The enthusiasm for excellent presentation characterized the entire program.

VI. The Science Program

The status of the science course of study in Dedham presented various difficulties which inveighed against a program of individualized instruction. In two grades, the fifth and sixth, the science program was sharply controlled by the television program which had been arranged prior to the research year; likewise, only one hour was allotted to science study in the weekly schedule. This limited time factor, coupled with a lack of science materials and textbooks, prevented an intensive program from being conducted.

The science program was implemented largely through a specialties calendar of events centering about such topics as:

Grade IV

Sulphur in Mexico
Salt
Dinosaurs
Glass
The blood stream
Skeletons
Pasteurized milk
Dragonflies
Submarines
Rubber
The sun turtle
Tulips
Field arts
Weeds
Thermometers
Kinds of sugar
How air moves
Insects are animals
Aqueducts
Silkworms
Molds
Polaroids
Rayon
Mica
Pearls

Grade V

Superstitions about insects
The changing land
Tin ore
Crystals
Asbestos
Earth's magnetic field
Life cycle of the red ant
Chemical indicators
Copper plating
Elevators
Steel
Plastics
Bullets
True diseases
Flowering shrubs
Whales
Gila monster
Beef
Echoes
Ambergris
Diesel engine
Nitrogen
Life of a hamster
Solar halo

Grade VI

Volcanoes
Earthquakes
Missiles
Solar system
Sound
Insects
Fungus
Hydro electric power
Lichens
The circulatory system
Weather forecasting
Moths
Cellulose
Perching birds
I G Y
Steam engines
Strange fish
Measuring time
Metric measure
Levers and wedges
Fabrics
Fingerprinting
The dry cell
Birds of prey

The resources of the Dedham Public Library were heavily employed in this specialty program. Science books, which normally would be part of the circulating editions, were placed in a science reference section for use in the main library when needed.

VII. The Balanced Reading Program

With the team-learning techniques used in the classrooms and the acceleration of pupils due to the individualization of skills instruction, much time was saved. Pupils, allowed to read their basal readers at their own rate, soon exhausted their content. Likewise, in spelling and arithmetic, brighter pupils were saving time by not being exposed to excessive drill. This saved time was to be used for various enrichment purposes, the first being a balanced reading program.

Children often tangent their reading toward one specific item of interest to the exclusion of other worthwhile topics. To avoid this situation a balanced reading program was instituted to serve the reading needs of the brighter youngsters.

The Dedham Public Library, through its director, Mr. Robert Woodward, and the children's librarian, Mrs. Peters, afforded us this opportunity. Library boxes containing books of specific interests were distributed to the schools. These boxes contained books pertaining to such topics as:

1. Books by one author
2. Biographies
3. Science
4. Sports
5. Mysteries
6. Foreign lands

No attempts were made to classify the books beyond the interest factor. These books were circulated among schools and among the intermediate-grade classrooms within each building. It was necessary, then, to rearrange the daily schedules to suit this phase of the program. This was accomplished with but slight inconvenience.

That this program increased library reading activity was of significant note. Library authorities found that circulation increased tremendously in those areas of interest. The circulation of the children's department doubled that of the 1957–1958 academic year.

This reading program provided advantages to all pupils. Aside from periodic comprehension and vocabulary checks, the advanced readers were able to enjoy their reading period unhampered by the slower pupils. Further, they were able to pursue their own interests in books of quality. The teacher was thus able to devote added time to the teaching of the slow and average readers. Modifications of the oral reading period for bright pupils increased the amount of time the teacher was able to spend with those children who had special reading weaknesses of an individual nature.

The enrichment reading program was not confined to independent activities, however. Choral reading of selected prose passages and poetry provided ample enrichment opportunities involving the entire class. Play reading and dramatizations likewise provided audience situations for whole class participation. These activities were an integral part of the reading program and provided opportunities for the improvement of oral and expressive reading.

VIII. CONSOLIDATION PHASES OF THE PROGRAM

With each new phase of the program introduced, supervision of previous phases was intensified. The daily school meetings were continued; these were more critical than organizational in nature. If change of existing individual practices was needed, change was effected either by the teacher under the supervision of the research fellow or by demonstration by the latter. In no instance was poor discipline or disorganization tolerated; attempts at individualization which fell awry were started again under increased supervision and tighter teacher control. Though individualization of instruction was the aim of the program, it was understood by the Dedham elementary faculty that the means would not be mere individual activity with no direction or control. Adequate classroom discipline demands purposeful activity and pupil initiative governed by self-control; Dedham classrooms suited this description.

The constant supervision of the existing program by the principals and research fellows, the daily meeting concerning problems and changes of method, the demonstrations of better methods, and reorganizational activities, all served to consolidate the program into a harmonious, disciplined, and directed learning environment.

IX. ANALYSIS OF RESULTS

Measures and Their Limitations. Outcomes in the content areas were measured through the Metropolitan Achievement Tests, Forms R and T. These tests measure items of factual information in each subject. Such tests do not measure many of the specific objectives included in the experimental program, such as the following: reference and research abilities, improvement of oral reporting, ability to organize materials, improved written expression, elaborative and critical thinking, ability to take part in discussion, enrichment of concepts, and development of pupil initiative in a variety of interests. Any thorough evaluation of improvement of learning in content areas awaits the construction of valid measures of these objectives. On the aspects of growth measured by the standard tests used, the following comparisons of achievement are made.

Social Studies Achievement. Table 1 presents the differences between social studies achievement at the end of 1958, before the experimental program, and at the end of 1959, after the program. The social studies score was obtained by combining the scores from the history and geography measures. Description of the populations included in this study are found in Chapter 3, Tables 1–4. Measures in the content areas were available for grades five and six only.

TABLE 1

SOCIAL STUDIES ACHIEVEMENT: 1958 VERSUS 1959

	Grade Five		*Grade Six*	
	1958	*1959*	*1958*	*1959*
N	241	187	313	336
Mean Score	202.3	204.1	215.0	217.8
Grade Equiv.	6.7	6.9	8.1	8.5
$S.E._m$	1.2	1.3	1.1	1.1
Difference	1.8		2.8	
$S.E._{diff}$	1.9		1.5	
Critical Ratio	.98		1.8	

In total social studies achievement, the differences favor slightly the experimental groups. There was an improvement of two months in grade five, four months in grade six. Neither of these differences are statistically significant.

History Achievement. Table 2 compares the achievements in history at the end of the two measurement periods.

TABLE 2

HISTORY ACHIEVEMENT COMPARISON

	Grade Five		*Grade Six*	
	1958	*1959*	*1958*	*1959*
N	241	187	313	336
Mean Score	205.2	203.4	213.6	213.5
Grade Equiv.	7.0	6.8	7.9	7.9
S.E.$_m$	1.3	1.4	1.1	1.0
Difference	—1.82		—.05	
S.E.$_{diff}$	1.9		1.5	
Critical Ratio	.91		.03	

Grade five showed a loss of two months in achievement in history as measured by the standard test; there was no change in grade six. It should be noted that achievements in both grades was almost a year above the national norms.

Geography Achievement. Table 3 shows the changes in geography achievement under the program of differentiated instruction in grades five and six.

TABLE 3

GEOGRAPHY ACHIEVEMENT COMPARISON

	Grade Five		*Grade Six*	
	1958	*1959*	*1958*	*1959*
N	241	187	313	336
Mean Score	198.9	204.1	216.1	220.7
Grade Equiv.	6.4	6.9	8.3	9.1
S.E.$_m$	1.3	1.4	1.2	1.2
Difference	5.2		4.6	
S.E.$_{Diff}$	1.9		1.7	
Critical Ratio	2.7		2.7	

In geography, as measured by the standard tests, the differentiated program produced improvements of five months in grade five, eight months in grade six. The 1959 achievement in grade six is two years above the national norm.

Literature Achievement. Table 4 shows the changes in achievement in literature following the experimental program.

TABLE 4

LITERATURE ACHIEVEMENT

	Grade Five		*Grade Six*	
	1958	*1959*	*1958*	*1959*
N	241	187	313	336
Mean Score	198.7	206.4	211.1	219.1
Grade Equiv.	6.3	7.0	7.6	8.6
S.E.$_m$	1.2	1.5	1.1	1.2
Difference	7.7		7.9	
S.E.$_{diff}$	2.1		1.7	
Critical Ratio	3.8		4.7	

There was a seven months gain in literature achievement in grade five, a ten months gain in grade six. These differences were statistically significant.

Science Achievement. Table 5 compares science achievements of the experimental and control groups in the fifth and sixth grades.

TABLE 5

SCIENCE ACHIEVEMENT

	Grade Five		*Grade Six*	
	1958	*1959*	*1958*	*1959*
N	241	187	313	336
Mean Score	203.0	206.9	213.4	218.2
Grade Equiv.	6.7	7.1	7.6	8.1
S.E.$_m$	1.3	1.6	1.1	1.4
Difference	3.8		4.8	
S.E.$_{diff}$	2.1		1.8	
Critical Ratio	1.8		2.6	

Science achievement showed improvement in both grades under the program of differentiated instruction. There was a gain of four months in grade five, of five months in grade six. The gain in grade six is statistically significant.

Comparison of Achievement Scores by Intelligence Quotient Levels. Table 6 compares the social studies, literature, and science achievements of those pupils whose I.Q. range is 120 and above. The comparisons are by grade equivalents; an asterisk in the gains column indicates significance at the 1% level of confidence.

TABLE 6

Achievements of Pupils of 120 I.Q. and Above

	Grade Five			Grade Six		
	1958	*1959*	*Gain*	*1958*	*1959*	*Gain*
Social Studies	8.4	7.8	—.6	10.5	10.8	.3
Literature	8.0	8.2	.2	9.3	11.3	2.0*
Science	8.1	8.1	.0	8.7	9.7	1.0*
N	35	16		70	58	

* Significant at 1% level.

Social studies in grade five shows a loss of six months; in grade six there was a gain of three months. Neither of these changes is statistically significant.

For these bright children, there was a slight gain in literature in grade five, a statistically significant gain of one year in grade six. Science showed no change in grade five, a significant gain of one year in grade six. The sixteen pupils in grade five had a mean I.Q. three points lower than the thirty-five pupils in the 1958 group, but this is not sufficient to account for the loss in social studies. Mean intelligence quotients of the grade six groups was the same for both years.

Table 7 compares the social studies, literature, and science achievements of children whose intelligence quotients ranged between 95 and 119. The means are in grade equivalents; an asterisk denotes statistical significance at the 1 per cent level of confidence.

TABLE 7

Achievements of Pupils with I.Q.'s of 95–119

	Grade Five			Grade Six		
	1958	*1959*	*Gain*	*1958*	*1959*	*Gain*
Social Studies	6.6	7.1	.5*	8.0	8.5	.5**
Literature	6.4	7.4	1.0*	7.5	8.5	1.0*
Science	6.7	7.3	.6*	7.6	8.0	.4
N	174	144		208	237	

* Significant at 1% level.
** Significant at 5% level.

Statistically significant gains are found in all subjects except science in grade six. Both grades made gains of five months in social studies, a year in literature.

Table 8 compares mean grade equivalent scores for children with intelligence quotients below 95.

TABLE 8

ACHIEVEMENTS OF PUPILS WITH I.Q.'S BELOW 95

	Grade Five			*Grade Six*		
	1958	*1959*	*Gain*	*1958*	*1959*	*Gain*
Social Studies	5.3	5.2	—.1	5.6	6.5	.9**
Literature	4.7	4.8	.1	5.3	5.9	.6
Science	5.1	5.1	0	5.4	6.6	1.2*
N	32	27		35	41	

* Significant at 1% level.
** Significant at 5% level.

Very slight changes in achievement in grade five were found among these children with low intelligence quotients. In grade six, however, statistically significant gains were found in social studies and science.

SUMMARY OF FINDINGS

A program of differentiated instruction was provided for children in intermediate-grade classrooms during the academic year 1958–1959. Measures of the achievements in history, geography, literature, and science were compared with similar measures of children under the same teachers the previous year. There were nine fifth-grade classrooms and fourteen sixth-grade classrooms available for the study. A summary of findings is presented below.

1. There were no significant changes in achievement in history as measured by the standard test used.
2. Geography improved significantly under the differentiated program; grade five made a mean gain of five months, grade six a mean gain of eight months.
3. Literature achievement was significantly improved under the program of differentiated instruction; a gain of seven months was found in grade five, a gain of one year in grade six.
4. Science achievement also showed improvement under the experimental program; the gain of five months in grade six was statistically significant.
5. For pupils with I.Q.'s of 120 and above, significant improvement was found in science and literature in grade six; there was a loss in social studies achievement in grade five; other changes were minor.
6. Among pupils with I.Q.'s of 95 to 119, statistically significant gains were made in social studies, literature, and science in grade five; in social studies and science in grade six.
7. Children with I.Q.'s below 95 showed no changes in achievement in grade five; the grade six pupils, however, made statistically significant gains in social studies and science.

Chapter 5

EVALUATING SOCIAL-PERSONAL OUTCOMES IN DIFFERENTIATED INSTRUCTION

GEORGE B. ROCHFORT, JR.

This chapter concerns changes in pupil interests, attitudes, and adjustment resulting from differentiating instruction in intermediate-grade classrooms. Changes in achievements of pupils are reported in Chapters 3 and 4.

The first concern of a program of differentiated instruction is improvement in achievement. Of equal concern, however, are pupil attitudes and adjustments. It is expected that pupils will work harder when instruction is adjusted to their different levels of ability; but will this harder work result in greater or less enjoyment of learning? If teams progress at different rates in arithmetic and spelling, if different assignments are used for bright and dull pupils, what will the attitudes of other pupils be toward rapid learners and slow learners? Will the social climate of the classroom diminish or improve when the various forms of team learning are used? Will the behavior of pupils be better or worse when there are many different activities going on at once in the same classroom? These are some of the questions to be answered in this chapter.

The following measures were among those used in May of 1958, under the program of relatively uniform instruction, and repeated in May 1959, when the differentiated instructional program was in progress:

A modified Bogardus social distance scale.
A scale of pupil subject interest.
Teacher ratings of pupil adjustments.

Each measure will be described briefly, with the findings of the two years.

Attitudes of Pupils Toward Their Classmates. When children in the same classroom are permitted to work at different levels and progress rates, there is a concern for classroom climate as expressed in pupil attitudes toward their classmates. Each child was given a sheet which contained the names of all of his classmates. His attitude toward each was expressed by checking under a column head which best expressed his feeling toward that pupil. The columns were headed as follows:

	Scored
Would like him as one of my best friends.	4
Would like him in my group but not as a close friend.	3
Would like to be with him once in a while but not often.	2
Would rather not work with him.	1

To obtain a score for each pupil, the ratings given him by his classmates were averaged. A pupil might rate as high as 4 or as low as 1. Table 1 shows the comparisons of the mean scores for the different grades in 1958 and 1959.

TABLE 1

SOCIAL DISTANCE COMPARISONS

	Grade Four		*Grade Five*		*Grade Six*	
	1958	*1959*	*1958*	*1959*	*1958*	*1959*
N	252	276	217	183	305	326
Mean	2.77	2.76	2.77	2.90	2.90	2.94
$\text{S.E.}_{\text{mean}}$	.03	.02	.03	.04	.03	.03
$\text{Diff.}_{\text{means}}$	—.01		.13		.04	
$\text{S.E.}_{\text{Diff}}$	.04		.052		.037	
Critical Ratio	.25		2.50		1.08	

There was little change in the attitudes of pupils toward each other after the program of differentiated instruction was introduced. The average rating in all grades for both years was slightly below the rating, "Would like him in my group but not as a close friend." Only in grade five did the change approach statistical significance.

Since there might be changes in attitudes toward bright or dull children in the differentiated program, an analysis was made of social distance ratings when pupils were divided by intelligence levels. The results are shown in Table 2.

TABLE 2

SOCIAL DISTANCE BY INTELLIGENCE LEVELS

	Grade Four			*Grade Five*			*Grade Six*		
	1958	*1959*	*Change*	*1958*	*1959*	*Change*	*1958*	*1959*	*Change*
120 I.Q. and above	2.76	3.00	.24*	3.14	3.17	.03	3.01	3.06	.05
(N)	(23)	(33)		(31)	(15)		(68)	(58)	
96–119	2.84	2.78	—.06	2.85	2.94	.09	2.92	2.92	.00
(N)	(189)	(197)		(154)	(141)		(202)	(230)	
95 and below	2.40	2.52	.12	2.70	2.55	—.15	2.60	2.83	.23

* Significant at the 1% level.

Bright children were rated slightly higher by their classmates under the program of differentiated instruction; the improvement was significant only in grade four. Attitudes toward dull children also improved slightly in grades four and six, were less good in grade five; none of these changes were statistically significant. It is apparent that the program of differentiated instruction did not affect adversely the attitudes of pupils toward their classmates. It is interesting to note that brighter children were generally better liked.

Interest in School Subjects. In order to discover whether or not children's interests in school subjects improved under the differentiated instruction program, each child was asked to rate school subjects on the following scale:

	Scored
I like it very much.	5
I like it.	4
I neither like nor dislike it.	3
I don't like it.	2
I dislike it very much.	1

The ten subjects rated were the following: reading, arithmetic, spelling, language, geography, history, science, handwriting, art, and music. The ratings the pupil gave the subjects were totaled. A child disliking every subject very much would total 10; a child liking every subject very much would total 50. Table 3 shows the mean scores for each grade for 1958 and 1959.

TABLE 3

TOTAL SUBJECT INTEREST RATINGS

	Grade Four		*Grade Five*		*Grade Six*	
	1958	*1959*	*1958*	*1959*	*1958*	*1959*
N	252	276	217	183	305	326
Mean	40.61	38.85	36.11	39.55	38.90	38.47
$\text{S.E.}_{\text{mean}}$	.38	.37	.65	.37	.29	.32
$\text{Diff.}_{\text{means}}$	—.76		3.44		—.43	
$\text{S.E.}_{\text{diff}}$	.53		.75		.43	
Critical Ratio	1.44		4.63		.99	

Grade five made a significant gain in interest in school subjects, but there were very slight losses in grades four and six. The mean rating varies only slightly from the "I like it" rating for both years.

Table 4 shows changes in subject interest by intelligence quotient levels.

TABLE 4

SUBJECT INTEREST BY INTELLIGENCE LEVELS

	Grade Four			*Grade Five*			*Grade Six*		
	1958	*1959*	*Change*	*1958*	*1959*	*Change*	*1958*	*1959*	*Change*
120 I.Q. and above	41.35	40.33	—1.02	36.10	41.53	5.43**	40.87	40.19	—.68
(N)	(23)	(33)		(31)	(15)		(68)	(58)	
96–119	41.10	40.38	—.72	36.51	39.94	3.43*	38.68	38.12	—.56
(N)	(189)	(197)		(154)	(141)		(202)	(230)	
95 and below	37.90	37.22	—.68	34.16	36.37	2.21	36.37	37.97	1.60
(N)	(40)	(46)		(32)	(27)		(35)	(38)	

* Significant at 1% level.
** Significant at 5% level.

There are slight but statistically insignificant differences in subject interest in the different intelligence levels in grades four and six. The subject interest of the brightest group of fifth graders improved significantly at the 5% level, while the middle group improvement was significant at the 1% level.

Table 5 compares the means of subject interest in the following subjects: reading, arithmetic, spelling, language, geography, history, and science. The highest possible score in each subject is 5.

TABLE 5

INTEREST RATINGS BY SEPARATE SUBJECTS

	Grade Four			*Grade Five*			*Grade Six*		
	1958	*1959*	*Diff.*	*1958*	*1959*	*Diff.*	*1958*	*1959*	*Diff.*
N	262	261		192	175		263	244	
Reading	4.31	4.38	.07	3.79	4.27	.48*	4.09	4.25	.16*
Arithmetic	4.00	4.00	.00	4.00	4.12	.12	3.98	3.97	—.01
Spelling	4.25	4.15	—.10	4.29	4.12	—.17	4.28	4.18	—.10
Language	3.62	3.55	—.07	3.45	3.45	.00	3.50	3.28	—.22*
Geography	4.05	3.68	—.37*	3.65	3.81	.16	3.80	3.84	.04
History	3.92	3.71	—.21**	3.68	3.88	.20	3.58	3.64	.06
Science	4.18	4.12	—.06	3.95	3.96	—.01	3.90	3.56	—.34*

* Significant at 1% level.
** Significant at 5% level.

The increase in reading interest was significant in grades five and six. In grade six there was a significant drop in interest in language and science. Grade four showed significant losses in interest in geography and history. Interest in all subjects varied around the "I like it" rating. Although the differences in subject interest are not large, the subjects are rated in this order by the pupils: reading, spelling, arithmetic, science, geography, history, and language.

Teachers' Estimates of Classroom Adjustment of Pupils. Teachers rated attitude, initiative, and general behavior of pupils each year. The items were grouped by subjects, in which were rated such factors as attention, persistence, and desire for improvement. In addition there was a rating of general classroom attitudes: dependability and promptness, willingness to help others, initiative and leadership, contribution to class morale, and general classroom behavior. Ratings on each item were as follows:

	Scored
Superior	4
Good	3
Fair	2
Poor	1

Since there were 21 items rated, a maximum for any pupil is 84; the lowest possible score is 21. Table 6 compares the mean scores of the 1958 population with those of 1959.

TABLE 6

SCHOOL ADJUSTMENT COMPARISONS

	Grade Four		*Grade Five*		*Grade Six*	
	1958	*1959*	*1958*	*1959*	*1958*	*1959*
N	265	276	217	183	305	326
Mean	61.90	60.14	57.94	57.59	60.15	58.95
S.E.$_{m}$	.96	.87	1.24	1.26	.84	.82
Difference	—1.76		—.35		—1.20	
S.E.$_{diff}$	1.29		1.77		1.17	
Critical Ratio	1.36		.20		1.03	

The comparisons of the 1958 ratings with those of 1959 show that there were slight but statistically insignificant losses in pupil ratings in all grades. It is possible that teacher standards of pupil attitudes and behavior may have changed in the program of differentiated instruction. However, it is impossible to determine whether standards might have been more rigorous or less.

Table 7 compares teacher estimates of the classroom attitudes and adjustments of pupils by intelligence quotient levels.

TABLE 7

SCHOOL ADJUSTMENT BY INTELLIGENCE LEVELS

	Grade Four			*Grade Five*			*Grade Six*		
	1958	*1959*	*Change*	*1958*	*1959*	*Change*	*1958*	*1959*	*Change*
120 I.Q. and above	71.22	71.09	—.13	73.32	70.53	—2.79	67.81	71.22	3.41
(N)	(23)	(33)		(31)	(15)		(68)	(58)	
96–119	64.46	61.47	—2.99**	58.51	59.66	1.15	60.27	58.04	—2.23
(N)	(202)	(179)		(154)	(141)		(202)	(230)	
95 and below	44.45	46.59	2.14	40.31	39.59	—.72	44.54	45.71	1.17
(N)	(40)	(46)		(32)	(27)		(35)	(38)	

** Significant at the 5% level.

The highest intelligence quotient group showed losses in teacher ratings of pupil adjustment in grades four and five, improvement in grade six; none of these changes were statistically significant. The middle group in intelligence in grade four showed a loss which was significant at the 5% level. The lowest group showed gains in grades four and six, a loss in grade five, but these changes were not statistically significant. It is interesting to note that teacher ratings of pupil interest, initiative, and general behavior varied sharply with the intelligence of the pupils; the brighter children had much higher ratings.

SUMMARY OF FINDINGS

Informal inventories and ratings were made of pupil interests, attitudes, and adjustments in May 1958, under the program of relatively uniform instruction, and in 1959 under the differentiated program. An analysis of the results yields the following findings:

1. The attitudes of pupils toward each other showed little change under the program of differentiated instruction. Attitudes toward bright children were improved in all grades, but the difference was significant only in grade four. Attitudes toward dull children improved slightly in grades four and six, was slightly poorer in grade five; none of these changes were statistically significant.
2. Interest in school subjects under the differentiated program improved significantly only in grade five. When the population was divided by intelligence levels, all levels in grade five showed improvement; all levels in grade four showed slight losses; the two higher levels in grade six showed slight losses, while the dull group gained slightly.
3. Changes in interest in the separate subjects under the differentiated program showed a statistically significant improvement in reading in grades five and six; grade four showed significant losses in interest in geography and history; grade six had significant losses in interest in language and science; all other changes in subject ratings were not significant statistically.
4. Teacher estimates of pupil attitude, initiative, and general behavior showed no significant changes under the differentiated program. The ratings were slightly lower at all grade levels. An analysis of change by intelligence levels showed no significant differences, except a loss in the middle group in grade four.

In the area of interests, attitudes, and classroom adjustment, the differentiated program showed no clear improvements over the previous program which consisted of relatively uniform instruction. While the data are based on subjective ratings in which standards of pupils and teachers may have changed as the school program changed, the measures used are not adequate to show the nature of the changes, if any, in standards.

Chapter 6

PROBLEMS AND POSSIBILITIES IN DIFFERENTIATING INSTRUCTION IN THE ELEMENTARY SCHOOL

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The program of differentiated instruction in Dedham intermediate grades produced marked improvement in many areas; there were also disappointments and unexpected findings. At the outset, the research team expected that all grades would show significant improvement in average achievement in all subjects. Rapid and slow learners were expected to show more improvement than average achievers, since it was assumed that uniform instruction fitted the latter group better. It seemed that team progress methods in arithmetic and spelling would result in marked improvement in these subjects. Less was expected from reading and language arts, for two reasons: first, it was difficult to adapt current instructional materials to serve the multiplicity of skills in those subjects; second, there is much out-of-school learning in these areas, especially among bright children. It was hoped, but not confidently expected, that history, geography, science, and literature would respond well to the program of specialties, study guides, team discussion, and enrichment; the chief difficulty here was the lack of adequate measures of the abilities taught. It seemed that boys might show unusual gains in a program which called for greater pupil activity and responsibility. It was also expected that the social-personal measures would reveal improvements and that there would be greater parent satisfaction with school service.

The findings presented in the preceding chapters show how these expectations were met. Average achievement improved significantly in grades five and six, but the results were disappointing in grade four. Rapid learners benefited by the program in grades five and six, but did not respond in grade four; achievements of slow learners improved in all grades; the middle group of children made significant improvements in grades five and six, but showed slight losses in grade four. Spelling improved significantly in all grades; arithmetic improved markedly in grades five and six. but again grade four showed no gain. Reading improved significantly only in grade six, as did language arts. There was no change in achievement in history, but geography and literature improved significantly; science achievement also was raised. Boys improved more than did girls in all subjects in grades four and five, but grade six girls improved more than boys. There were no significant changes in social-personal measures, except in grade five where interest in school subjects improved. Parent satisfaction with school service remained essentially the same as in the previous year.

In evaluating the program, consideration should be given to the fact that the Dedham intermediate classrooms showed high achievements in the "control" year. These children were achieving an average of nine months above the national norms when the experiment started; it was necessary, therefore, for the experimental program to make even greater gains, and certainly to maintain the already high achievements. The

Dedham elementary schools had worked at a program of improvement of instruction in the previous years; class sizes were kept relatively small, with an average enrollment of 25; there were numerous committees at work in various aspects of the curriculum; principals were active in the supervision of instruction; standard tests results were examined closely each year; the schools were important to the community and education was a matter of community pride and concern.

It is important to note that these high achievements in the control year were made under a program of relatively uniform instruction. Even under such instruction, there are opportunities for improved quality of teaching and learning, and for bright and dull children to learn. Reading is probably improved as much by out-of-school voluntary reading as by classroom instruction, except for slow learners who require intensive skills practice. Speaking and writing skills also reflect home backgrounds. Arithmetic, however, is likely to be limited to classroom opportunity, as are specific skills related to other subjects. If the school provides adequate enrichment of social studies and science through multi-sensory presentation, discussion, and projects, both bright and dull children may profit by the instruction. Certainly there are variations in the quality of teaching under uniform instruction. It was the task of the differentiated program to preserve the values in uniform instruction and to add opportunities for increased achievement.

It is difficult to account for the fact that the high achievements of the fourth grade in the "control" year were only matched, but not exceeded by the experimental program. Only in spelling was there a significant improvement. Pupils below 95 I.Q. showed slight gains, with the result that a higher percentage of children made a "year or more progress," but this was offset by slight losses in the 95–119 I.Q. group. The tests used had sufficient ceilings to measure improvement. The entering educational achievements of the experimental and control fourth grades were approximately equal, as shown by standard test results given in April in the third grades. There were two classrooms in which achievements were much below the control year; if these were omitted there would have been slight gains, but there seemed to be no valid basis for excluding them. All that can be said for the differentiated program in the fourth grade in this experiment is that it maintained the high achievements of the control year, but produced significant improvement only in spelling. Further experiment will be required to evaluate the differentiated program at this grade level.

The question most commonly asked is, "Now that the experiment is over, do the Dedham teachers continue the program in team learning?" Long before the experimental year was over, it was evident that few teachers would willingly depart from the team learning program. They were deeply involved in the planning of materials and procedures; they had demonstrated the methods before large numbers of visitors; they had taken part in many educational conferences where they had demonstrated or explained the techniques and values in team learning. Their assurance of the progress of their pupils in established subjects led to the addition of foreign language in more than half of the classrooms. On the basis of the acceptance of the program by the teachers and the results of the achievement tests, the program in team learning was unanimously endorsed by the school committee.

Improvements in the program are being pursued, especially in those subjects in which teachers rated the service to pupils as only "good" or "fair." There are committees at work developing and revising materials of instruction in these subjects. New reference materials related to pupil specialties are being provided by the schools and by the public library. Intensive remedial materials are being purchased and developed for slow learners in skills areas. Typewriting has been added as a new subject in twelve fifth- and sixth-grade classrooms. Greater use of teacher resources is being utilized through a new program on Wednesdays in which teachers select a special field in science, art, music, literature, or physical education, and teach these to several classrooms. This is supplementary to the regular services in these fields. Any visitor to Dedham will find the team learning program well established.

A second question is, "How does team learning relate to other levels of the Dedham schools?" There is especial concern for the sixth-grade pupils who completed two and three years of arithmetic. For these pupils, the junior high school has established two sections of algebra in the seventh grade, with team progress methods being tried in these sections. Both junior and senior high school staffs have held special meetings on the possibilities of team learning, but as yet there have been no major changes in their offerings. In primary grades, however, pupil team instruction is being tried in several subjects where suitable material is available.

Interest in pupil team learning as a means of providing for individual differences is not limited to Dedham. In November 1958, the team learning methods were demonstrated to a conference of 175 elementary school principals. As a result, a "laboratory in team learning" was offered in Dedham as an extension course by Boston University. The requirements for admission were as follows: only teams of principals-with-teachers would be accepted for enrollment; demonstrated methods of team learning would be followed in the classrooms of the participants for the duration of the course. Principal-teacher teams from twenty-one communities were enrolled. Visits were made to more than half of the participating schools where it was found that the team learning methods were readily adopted and were spreading to other classrooms. The laboratory in team learning is being continued as an extension offering, with twenty-four principal-teacher teams enrolled in the fall course.

Research Opportunities in Differentiated Instruction.

1. *Administrative organization for differentiated instruction.* Many elementary school staffs are searching for ways to provide for individual differences. Most of the proposed plans utilize some form of ability grouping or departmentalization. Ability grouping is thought to reduce the range of instructional need, while departmentalization offers increased specialization of teachers; objections to both have been well publicized. Ability grouping within the classroom seems to have greater acceptance in primary than in intermediate grades. Special classes and special services for the gifted are multiplying rapidly; remedial reading classes and services have long been accepted. One sees descriptions of "ungraded elementary schools" and "continuous progress programs," but when visited they are usually found to be expressions of hope rather than reality. A truly "ungraded" school requires teaching materials of the Winnetka type.

Pupil team learning might well be combined with ability grouping, departmentalization, special classes for the gifted or retarded, or with individualized programs. It is concerned with effective use of learning time, and relates more closely to learning objectives and types than it does to any organization of pupils for instruction. In order to discover the value of team learning in different situations, many controlled studies are desirable. How does uniform teacher-led instruction in ability grouping compare with team learning in the same type of organization? Can bright pupils achieve as well in self-contained classrooms using team learning methods as they can in separate classes for the gifted? Do individualized materials work better when pupils are combined into teams using the same material?

The combination of mass instructional procedures, such as television, motion pictures, teacher demonstration, and even lectures, with team reaction to the presentation offers good research possibilities. Mass media may be satisfactory in imparting ideas and information, but use of ideas in recall, thinking, planning, and action may be markedly improved through team reactions. Furthermore, research needs to discover whether or not class discussion in groups of twelve to twenty-five produces as good results as discussion in teams of three to five.

2. *Team size in relation to learning effectiveness.* The following assumptions in relation to group size and make-up need to be tested through controlled research:

    a. That groups of three to five pupils of differing abilities are best for discussion involving selective recall, elaborative and critical thinking, organization of ideas. Would the learning be equally effective if whole-class discussion replaced team discussion? If the discussion groups were larger than five? If individuals worked alone on the same questions? If groups were made up of pupils of equal ability?

    b. That teams of two to three pupils of equal ability work best when independent progress is involved. Would individuals do as well as teams in materials which are self-administering, self-correcting? Can pupils of unequal ability be paired satisfactorily for some types of skills learning? Might the teams be larger?

3. *Arithmetic instruction.* Some arithmetic specialists argue the problem of acceleration versus enrichment and naturally favor enrichment. Some suggest a uniform course of study in each grade, with "deeper and broader" instruction for superior pupils. Nobody can be against enrichment and meaning in arithmetic; but if current textbooks are lacking in these, the remedy is to improve the textbooks. When this is done, the problem may be resolved into "uniform enriched instruction" versus "accelerated enriched instruction." Assuming the instructional materials to be adequate, some of the problems related to team learning in arithmetic are the following:

    a. How does team progress in arithmetic compare with ability grouping or with individual progress methods?

b. Do teams work better in problem solving than in computation skills?

c. Should there be a limit set on how far teams may progress in any grade, or may team progress be unlimited in mathematics?

d. Does team progress in arithmetic result in any losses in meaning and understanding of principles of mathematics, as compared to controlled progress in ability grouping?

e. Would arithmetic instructional materials be more satisfactorily "packaged" in various types of worksheets than in textbooks? Should such packages contain differentiated materials to fit more closely the needs of children of various levels of ability?

4. *Spelling instruction.* Although team learning methods in spelling were effective at all grade levels, there are many unanswered questions about instruction in spelling. The nature of spelling power — the ability to retain correct spelling with little effort — is somewhat obscure; formal instruction contributes only a small part of spelling growth, experiences in reading and language arts improve spelling ability; the variable nature of English phonics makes spelling difficult; too little is known about methods of improving written composition through transfer from spelling. Some of the problems directly related to team learning in spelling are the following:

a. Should pupils move into books of the next grade when the work of any grade is completed, or are there more effective ways to increase spelling achievement?

b. Can spelling be taught as well through the use of personal spelling lists as by formal instruction?

c. Can team learning contribute to greater transfer of spelling to use in written composition?

d. How should spelling be "packaged" for most effective learning in differentiated instruction?

5. *Reading instruction.* Reading showed little improvement under team learning, except in grade six. Literature scores, however, improved significantly. This may result from the replacement of textbooks with extensive reading for the superior pupils, and from the specialty program in literature. The lack of improvement in reading skills may be due to the inadequacy of reading skills materials suitable for differentiated instruction. Reading textbooks and workbooks are designed for class use; the specific skills are scattered throughout the textbooks; the desired systematic sequences which adapt to team learning are lacking. Some of the problems in reading which relate to differentiated instruction are the following:

a. Can the separate skills to be learned in reading be better "packaged" for team learning practice?

b. Which of the skills presented in readers are essential to an effective reading program in the intermediate grades?

c. How can team learning be utilized in acquiring the essential reading skills? In developing initiative in the many uses of reading?

d. What techniques develop greater growth and balance in independent reading?

6. *Language arts instruction*. Language arts consists of many relatively separate abilities such as the following: written composition, including flow of ideas, organization of ideas, and quality of expression; oral expression, which requires the same abilities as written composition, plus abilities in speech, discussion, and conversation; both require competence in language-grammar skills. Research in this area is badly handicapped by lack of objective measures of most significant abilities. Areas for research in differentiated instruction in language arts are many: the development of objective measures for analysis of learning needs; the packaging of specific elements of written and oral composition abilities for team practice; the study of size and make-up of pupil teams for best results in the several different abilities. Since language arts ranks lowest among subjects in pupil preference studies, a search must be made for practices which are acceptable to pupils and are effective in producing achievement.

7. *Instruction in the content areas: history, geography, science*. History showed little improvement under team learning, while both geography and science made significant gains. The improvement in science achievement may have come from greater emphasis on science in the experimental program; many of the specialties in social studies were science-related. Content areas used many different types of instruction, many different groupings of pupils; it is difficult to determine what elements in the differentiated program were effective, which ineffective. Some research possibilities related to team learning in these areas are the following:

   a. What separate abilities of a skills nature may be packaged for team instruction in these subjects?

   b. Since thinking abilities are paramount in content areas, what abilities in thinking should be taught, what size and make-up of teams most effective in teaching them?

   c. If pupil reports are to be an important part of enrichment, what types of team reaction to these reports will best assure retention and use of knowledge? The same question needs study for mass instruction methods, such as television, motion pictures, demonstrations, and lectures.

8. *Evaluation of teacher service to pupils*. The scale of teacher service to instructional needs of pupils, presented in Chapter 2, may be a useful research and service instrument for evaluation and analysis of programs of instruction. The high reliability found (.93) results from two examiners rating the same interviews, and from a wide range of teacher service ratings. Reliabilities determined from separate interviews on groups of teachers with narrower ranges of abilities would be lower. However, the scale has many advantages

over the usual forms of teacher rating. It emphasizes the key item of classroom service to pupils, rather than qualities of personality, amount of training and experience, and indefinite factors such as relationship to pupils. The scale indicates the specific elements of service to be improved in each subject; any teacher making the changes in service may improve her rating. Some of the possible research studies related to the scale and its use are the following:

a. Further reliability studies on the entire scale as well as on subjects within the scale.

b. Studies of the validity of the scale: Do high ratings in each subject assure high pupil achievements in these subjects?

c. Instructional surveys using the scale, to discover its possibilities as a tool for analysis of general and specific instructional needs in a school system.

d. Adaptation of the scale to different types of school organization. At present it is designed for teachers in the self-contained classroom.

e. How much and what types of training are required for supervisors and administrators to use the scale successfully?

9. *In-service programs for improving the individualization of instruction.* If there is to be a wide-spread improvement of differentiated instruction in elementary schools, there must be studies of techniques of initiating such services. Improvement of teacher education in undergraduate instruction or in part-time or summer courses will have little effect, since the individuals taking such courses are unlikely to change practices without the approval of their associates and their principals. The principal-teacher team enrollment, combined with demonstrations and a requirement of a trial of the recommended practices, has greater promise. Single research studies in isolated university centers cannot have the needed impact on the nation's schools. What is needed is cooperative research and service programs in several universities, each experimenting with methods of initiating differentiated instructional programs in public schools. An exchange of successful techniques, and the publication of the results of such programs, should result in increased effort to provide better service to the differing instructional needs of pupils.

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